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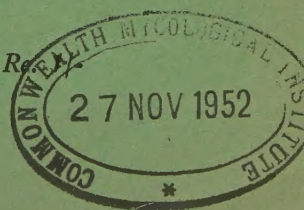


THE
FOURTH ANNUAL REPORT
OF THE
RESEARCH DEPARTMENT
OF THE
INDIAN COFFEE BOARD
(1950-51)



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INDIAN COFFEE BOARD

(Research Department)

THE FOURTH ANNUAL REPORT OF THE RESEARCH DEPARTMENT OF THE INDIAN COFFEE BOARD

(1950—1951)

INTRODUCTORY

1. **Administration.** I continued to be in charge of the Research Department throughout the year. Dr. N. G. Chokkanna, Mr. S. Sundaram, Mr. R. L. Narasimhaswamy and Mr. T. V. Pattabiraman continued to be the Chemist, Agronomist, Asst. Botanist and Liaison Officer respectively. Mr. S. Sundaram who was in charge of the sub-station and all the experimental portion of work in Coorg was transferred to Balehonnur on 28-12-1950 to continue as Agronomist. Mr. T. V. Pattabhiraman who was Liaison Officer with headquarters at Balehonnur, was transferred to Chethalli sub-station on 30-11-1950 to be the Liaison Officer and to be in charge of the experimental work in Coorg. Mr. James Colaco who was Superintendent at the headquarters station was transferred to Chethalli on 22-11-1950 to be in charge of the sub-station. Mr. L. V. Vaidyanathan who was appointed as Research Asst. in Chemistry joined duty on 7-5-1951. Two of the three fieldmen appointed under the 5-year plan joined duty towards the end of the year. Sri T. H. Thimme Gowda, Senior Fieldman at Chethalli was transferred to Balehonnur and promoted as Farm Assistant *vice* the Superintendent transferred to the sub-station. The appointment of one clerk which was temporary for one year was made on a permanent basis.

2. **Extension activities.**

(a) **Balehonnur:** The construction of a two-storeyed laboratory building and 8 staff quarters at Balehonnur was practically completed during the year. The laboratory equipment and furniture which arrived before the end of the year have since been fitted up and the building occupied. Two blocks of 12 labour quarters conforming to the latest requirements of housing accommodation were also completed. Two out of the three thatched houses were renovated, expanded and provided with A. C. sheet roofing. Sanitary fittings for 8 out of 16 staff quarters and additions to the old buildings were provided during the year under report and the work on the remaining quarters are in progress.

(b) **Chethalli:** Two senior staff quarters and two blocks of 4 junior staff quarters were nearing completion at the end of the year. The construction of 5 blocks of 25 modern labour quarters was completed. The engine and pump set received during the previous year were erected and the pipe lines laid. One 5.6 K. V. A. 'Cub Diesel' generator set was installed at the sub-station to provide lighting for the colony.

Seven acres of old coffee cleared during the previous year were cleaned up, pitted, shade planted with dadaps and the area was got ready for replanting in Aug-Sept. 1951.

At Balehonnur, a small area of $\frac{1}{2}$ acre of new clearing was planted to the latest selections in robusta and another small area which was under old

coffee, utilised for planting the latest selections in arabica. Besides these there was no addition to the planted area during the year.

3. Season and Crop.

(a) **Balehonnur:** The total rainfall received during the year was 137.86 inches as against an annual average of 104.23 for the decennial period 1940-41 to 1949-50. This constitutes a record during the decennial period beating the previous highest rainfall of 1946-47 by 12.04 inches. The month of July 1950 was the wettest on record on this station, the rainfall being 58.50 inches, the previous highest being 52.84 inches in 1927. July also recorded the second highest rainfall record in any one day of 7.26 inches which fell on 21-7-1950. The S. W. monsoon which commenced on the 31st May 1950 strengthened early in July and tailed off by the end of September. July 1950 had the lowest average number of hours of bright sunshine, the average being 8 minutes per day. Out of the total rainfall of 137.86 inches, 107.16 inches were received between the 1st July and 1st November. Of this, more than half was received during July. The last rain received in that year was on 15-11-1950. Thus there was a dry period of 4 months and 10 days between the last rain in November 1950 and the first blossom showers of 53 cents received on the 25th and two subsequent days in March 1951. No rain followed this until the 11th of April which was followed by backing showers. Though the blossom shower of 1951 was sub-normal, it was followed up by backing showers within 15 days. The estimated crop for 1951-52 is 10½ tons. The set and swelling of the robusta crop on a part of the estate was disappointing.

(b) **Chethalli:** The total rainfall for the sub-station amounted to 76.83 inches, slightly higher than the 10-year average of 73.29. The S. W. monsoon was quite active during the months of July, August and upto the 3rd week of September. The N. E. monsoon produced a rainfall of 7.30 inches in October-November which proved beneficial for the standing crop of coffee. Blossom showers of 1.75 inches were received on the 24th March and this was well backed up by lighter showers of 0.13, 0.15 and 0.14 inches on the 26th, 27th and 28th March 1951 which brought a very uniform blossom on the 2nd of April. A crop of 11½ tons is estimated on the blossom. The heavy blossom showers were also helpful in bringing out the full blossom of orange crop.

The meteorological data recorded on the two stations are given in appendices I, II and III.

RESEARCH

I. BOTANY

A. Breeding

4. Work on coffee breeding progressed according to the recommendations of the Expert Committee as detailed in the Third Annual Report (1949-50) of this Department. In particular, emphasis was laid on (1) production of hybrid seeds from controlled pollination of parents which are known to produce vigorous progeny, (2) vegetative propagation of clonal material from outstanding bearers, (3) comparative trials of clonal plants from the best performers and (4) a search for best bearers in private estates. Vegetative propagation of clonal material from outstanding bearers among arabica and robusta plants marked during 1949-50 was given a great impetus so as to enable experiments to be laid out in randomized replicated trials for singling out the best performers among these for eventual multiplication and distribution to growers.

5. **Arabica.** At Balehonnur, the breeding of arabica coffee with a

view to discover combinations of individual parents was continued. The table below furnishes the details:—

TABLE I—Breeding of arabica coffee at Balehonnur (Mysore)

No.	Method.	Purpose.	Procedure adopted.
1.	Hybridisation between two desirable parents.	To secure best combination to produce highest yield and vigour.	(a) 583·1/9 × 333·8 (b) do × S 26 (a) 583·6/11 × 583·1/9 (b) do × 327·3/10 580·2/13 × 645·1/6 645·1/6 × 583·1/9 (a) 327·3/10 × 583·1/9 (b) do × 644·1/13
2.	Selging of desirable selections.	For raising further progeny.	- Selection from F₁ of S. 26 × Kent. - Selection from F₁ of S. 31 × S. 22.
3.	Selging of selections from selfbred progeny of hybrids.	Testing of promising cultures in family blocks.	- Selection from 1st and 2nd selfed generation of S. 26. - Selection from 3rd selfed generation of S. 31. - Selection from 1st and 3rd selfed generation of S. 44. - Selection from 1st selfed generation of S. 72, S. 73, 583 and 585.
4.	Selging of desirable types.	To produce seeds for regional nurseries.	37 plants in S. 795 family (sibs 1-37) were covered with muslin bags when they were in blossom. 45 plants in S. 645 family (sibs 1-45) were covered with muslin bags when they were in blossom.

At Chethalli, the policy of raising foundation stocks of breeding material was pursued with plant material obtained mainly from Balehonnur and to a small extent from Ghattadhulla. The following quantities of seeds were supplied during the year from Balehonnur:—

S. 645	...	5 lb.
S. 795	...	5 lb.
S. 288	...	5 lb.
S. 333	...	5 lb.

The observations on the 1949 and 1950 plantings are furnished below:—

TABLE II—Breeding of arabica coffee at Chethalli (Coorg)

1949 PLANTINGS			
No.	Selections.	Procedure adopted.	Remarks.
1.	S. 288, S. 795, S. 645, S. 531 × Kents, S. 26 × Kents.	Grown in non-replicated blocks.	S. 531 × Kent and S. 795 were more vigorous than others.
2.	S. 288, S. 795, S. 645, S. 446.	Planted in latin Square of the following design— $\begin{array}{cccc} 446 & 795 & 645 & 288 \\ 645 & 446 & 288 & 795 \\ 795 & 288 & 446 & 645 \\ 288 & 645 & 795 & 446 \end{array}$	S. 446 was outstanding with plenty of crop. Next were 795, 645 and 288.
3.	S. 702, S. 838	Non-replicated plots.	Both are of good vigour and free from leaf disease.
4.	Rooted cuttings from S. 645, S. 31 and S. 795.	There were only 32 plants in these series.	There was no mortality during the year 1950-51. These plants had a large number of primaries and good blossom, but the blossom was stripped.

1950 PLANTINGS

No.	Selections.	Procedure adopted.	Remarks.
5.	S. 288	166 plants.	There was 20 per cent mortality in S. 288. Plants are expected to blossom during the ensuing season.
	S. 645	736 "	
	S. 795	736 "	
	S. 838	256 "	
	S. 702	183 "	
		2077 plants.	

Devamachi hybrids. Plants from seed material from 8 selections from the progeny of interspecific hybrids between arabica and robusta planted in 1949 except those from M-13 progressed satisfactorily.

A fresh batch of promising hybrids and second generation crosses were planted in 1950. There were no plantings in 1951.

6. *Field studies of advanced generation of hybrids:* The following were planted in a 'rubbish heap' block at Balehonnur (Mysore).

<i>Seedlings produced from</i>	<i>No. of seedlings planted</i>
4th selfed generation of S. 31	105
F ₁ of 288 × Maragotype	512
645 × Maragotype and reciprocal	57
645 × (F ₂ of Rob. × Kent) and reciprocal	101
645 × (520 × 327) and reciprocal	103
Arabica × (F ₂ of Rob. × Kent) and reciprocal.	191
[Kent × (Rob. × Kent) × Kent]	12
do do x Coorg	27
do do x 645	4
Maragotype × (F ₂ of Rob. × Kent) and reciprocal	25
Devamachi selections	733

7. The following clones obtained from Chethalli Sub-station were planted in strip plots at Balehonnur.

(i) <i>Devamachy:</i>	<i>No. of plants</i>
<i>Clonal progeny of</i>	
D.	11
D. 15	19
(ii) <i>Robusta:</i>	
M. 16	4
S. 28	7
S. 35	14
63-8	9

8. A further batch of seedlings was raised from seeds produced from the following:—

<i>Seeds produced from</i>	<i>No. of seedlings raised</i>
1st, 2nd, 3rd and 4th selfed gen. of S. 26	1320
S. 26 × 580 2/16	45
F and F ₂ of S. 26 × Kent	1016
F and F ₂ of S. 31 × S. 22	1417
S. 31 × 580·2/16	30
„ x 583·3/7	40
„ x 583 1/9	45
„ x 583·5/16	64
2nd selfed gen. of S. 44	420
1st selfed gen. of S. 72	100
1st selfed gen. of S. 73	30
1st selfed gen. of S. 61	77
1st and 2nd selfed gen. of 583	1002
1st selfed gen. of 585	270

9. **Character studies of some arabica selections.** The following table furnishes the analyses of the produce from clonal material of S. 26 and S. 31.

TABLE III.—Character studies of some arabica selections (Balehonnur)

Sl. No.	Characters	S. 26 (clones)					S. 31 (clones)				
		1947	1948	1949	1950	1951	1947	1948	1949	1950	1951
1	Percentage of triage.	36.8	22.5	12.6	12.4	10.5	35.3	11.4	8.9	5.0	14.3
2	Percentage of 'A' grade	40.2	21.3	28.0	46.7	50.0	44.9	51.2	31.2	55.1	25.7
3	Percentage of Peaberry	15.1	37.6	24.0	31.4	34.2	11.4	23.9	38.3	27.5	40.0
4	Wt. of 100 'A' grade beans-grms.	18.7	18.5	14.3	19.2	19.3	17.8	17.8	17.2	18.6	18.6

These observations support the conclusions recorded in the previous reports that the production of various grades of beans is apparently the result of seasonal factors.

10. **Selection from private estates.** (i) Yield records and analyses of the crop from the preliminary selections marked out last year in Netraconda estate (Mysore) were continued. The following table gives the figures:—

TABLE IV.—Character studies of preliminary selections from Netraconda Estate—(Mysore)

Selection No.	YIELD				Percentage of triage		Percentage of 'A' grade beans		Percentage of Peaberry		Wt. of 100 'A' grade beans grms.	
	Ripe cherry in ozs.		Clean Coffee per acre (1200) plants									
	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951
Net. A	49	128	7.3	19.5	15.8	10.3	28.6	37.9	28.6	37.9	21.6	20.96
" B	307	32	18.7	3.6	12.6	10.0	17.5	30.0	30.2	20.0	19.2	20.0
" C	304	54	26.1	3.6	36.0	7.3	42.7	40.0	15.7	22.9	22.0	19.6
" D	296	13	30.2	2.0	31.3	29.7	31.3	41.6	13.5	7.1	20.5	21.9
" E	82	6	10.2	0.7	14.3	5.3	39.3	55.0	18.6	40.0	20.5	...
" F	158	48	16.0	4.7	10.5	28.6	46.3	42.8	25.9	14.2	22.2	20.3

Note—Clean coffee is calculated on the basis of actual out-turn of coffee from ripe cherry harvested and shown in cwt.

(ii) Hybrid arabica and robusta seeds were obtained from marked plants in private estates and seedlings were raised from these at the main station. Details of the seeds collected and seedlings raised are given below—

Estate	Selection	No. of seedlings raised		Remarks
Kurkenmutty	Arab. Hyb. 1	33		Plants show resistance to leaf disease under field conditions and are having vigorous growth.
	do 2	80		
	do 3	40		
	do 4	28		
Kelgane	do	48		Seeds were collected from about 40-year old plants.
Mudigere	do	10		
Bhadra	Rob. 1	69		
	" 2	91		
Kumergod	"	153		Seeds were collected from plant having goldendrop fruits.
Cheekanahalli Rob.		49		Seeds were collected from a plant in a clearing raised from S. 274. The plant looked like a Rob. $\times$ Arab Hybrid having intermediate characters between the two.

(iii) Arabica coffee seeds received from Puerto Rico were sown at the Station. In spite of the best care and attention bestowed, it was not possible to obtain more than two seedlings from these.

11. **Robusta: (Chethalli).** The work on 8 selections (trees) from the chattadhulla robusta field in Coorg mentioned in the last report was not continued, but the following observations were made on the direct and reciprocal crosses made in 1947.

TABLE V—Intraspecific hybrids of robusta

Crosses	Procedure adopted	Remarks
1. Cross A 53—33 × 58—31 Reciprocal a 58—31 × 53—33	...	All are of fairly good vigour and free from leaf disease. No perceptible difference between direct and reciprocal crosses. There were 9 plants with bronze coloured leaves out of 100 crosses.
2. Cross B 59—9 × 58—16 Reciprocal b. 58—16 × 59—9	...	
3. Cross C 49—28 × 53—28 Reciprocal c. 53—28 × 49—28	...	All the plants have attained over 3' height this year. Most of them blossomed.
4. Cross D 63—8 × 46—20 Reciprocal d. 46—20 × 63—8	...	

12. **Extension work with selections.** The demand for seed obtained from selections has been on the increase and 400 lbs seeds were prepared on the Balehonnur Station during the year as against 253 lb. and 159 lb. in 1950 and 1949 respectively. The following table furnishes details.

TABLE VI—Quantities of seeds prepared for distribution

<i>Selections</i>	<i>Quantity</i>	
<i>Arabica</i> :	lb.	oz.
S.288	240	...
S.333	78	...
S.645	27	...
S.795	15	...
Total arabica selections	360	...
<i>Robusta</i> : S.274	40	...
Grand total	400	...

Practically all the coffee growing areas had their share of seed supply as could be seen from the following table.

TABLE VII—Distribution of seed coffee

Sl. No.	Areas.	Quantity of seeds supplied			
		Arabica.		Robusta.	
		lb.	oz.	lb.	oz.
1	Bababudangiri ...	55	12½	7	0
2	Aldur ...	5	7½	...	...
3	Belur ...	7	6½	0	8
4	Mudigere ...	16	14½	3	8
5	Saklasapur ...	27	4½	6	12
6	Hassan ...	...	...	0	4
7	Kalasa ...	19	6½	2	8
8	Balehonnur-Koppa ...	47	6½	7	12
9	Biligiris ...	5	4½	...	...
10	Coorg ...	76	9½	8	8
11	Malabar-Wynaad ...	19	3½	1	12
12	Travancore-Cochin ...	25	2	...	...
13	Nilgiris ...	15	15½	0	4
14	Coimbatore ...	1	12½	...	...
15	Anamalais ...	3	8	...	...
16	Shevaroys ...	16	2½	1	0
17	Vishakhapatnam ...	3	8	...	...
18	Tinnevely ...	1	12½	...	...
19	Bombay ...	0	4	...	...
Total ...		348	12½	39	12

Besides preparation and distribution of seed from selections 366 lb. of Kents arabica and 1 lb. of excelsa coffee seeds were prepared for supplies to planters. Also 1013 lb. of robusta from selections made on private estates was supplied.

13. Three hundred and twenty six clonal progeny of the following selections were planted in non-experimental plots on the estate.

<i>Arabica</i> :	S.288	...	79
	S.795	...	127
	S.645	...	69
<i>Robusta</i> :	S.274	...	51
Total ...			326 plants.

14. Thirty six clonal plants of S. 31 were utilised by the Chemist for laying out a fundamental experiment on the manurial requirements of coffee.

15. **Regional nurseries.** Out of 14 regional nurseries functioning in the previous year, one at Galikere estate became defunct. One additional nursery was started at Murkul estate (Mysore). There was a keen demand for seedlings from these nurseries and the scheme was of great benefit to several coffee growers in the neighbourhood. Quantity of seeds supplied to the regional nurseries, number of seedlings raised in them at the end of the year and the number of seedlings distributed to coffee planters are furnished in table VIII. A sum of Rs. 887-7-6 was realised by sale of seedlings from these nurseries as against a sum of Rs. 1296-8-4 paid to the estates and Government agencies towards the cost of raising and maintaining the nurseries. During the year, a slight modification was introduced in the terms and conditions for raising the regional nursery by which the estate or the Government agency is to bear the cost of raising and maintaining a seed bearing plot.

B. Vegetative Propagation:

16. At Balehonnur, the work on the production of clonal progeny from 36 arabica and 17 robusta cultures marked out as heavy bearers in the several families last year received special attention. With all the care, it has not been possible to raise sufficient number of rooted cuttings from all of them to provide planting material for randomised replicated plots. However a start has been made with rooted cuttings of 20 arabica and 10 robusta cultures. Special efforts were made during the current season to produce more suckers from those mother plants which were shy in sucker production in the previous year. Observations on rooted cuttings upto three years old have confirmed previous observations that upto three roots assume the role of tap roots and grow vertically downwards in the soil to give good anchorage to the plants. It has also been observed that the spreading of a layer of moss over the sand rooting medium inside the propagation chambers has helped to maintain a highly humid atmosphere during the dry months.

17. As the existing three blocks of propagation chambers were insufficient for carrying out the extended programme of vegetative propagation, six more blocks of ten units each were constructed. Thus there are now 9 blocks of chambers each consisting of 10 units in two rows of 5 each placed back to back. The internal dimension of each unit is 3 ft. x 3 ft. and can hold 150 arabica or 120 robusta cuttings.

18. At Balehonnur, 538 clonal plants from 36 arabica cultures and 343 clonal plants from 17 robusta cultures were produced besides 212 clonal plants from S.645 and S.795. The latter were used for planting up vacancies in the non-experimental plots in the estate.

19. At Chethalli, the propagation of clonal material for manurial experiments from 86 arabica and 50 robusta trees was continued. Considerable losses were sustained at this station during the hardening-off process. During 1950, 206 arabica cuttings and 198 robusta cuttings were rooted. During 1951, 809 arabica cuttings and 693 robusta cuttings were pre-cured by ring-barking. Towards the end of June, rooted cuttings were put out in the field for further multiplication. Out of 51 rooted cuttings of arabica put out in the field during the previous year, only 6 were able to get through the hot weather period.

TABLE VIII—Seeds supplied to regional nurseries and seedlings raised therein as at the end of the year.

Regional nurseries	Arabica selection					S. 274 Ro- busta	Total
	288	645	795	531 x Kent	S. 26 x Kent		
<i>Mysore</i>							
Murkul Estate, Javali P.O.							
Seeds supplied oz. ...	32	16	8	...	...	24	80
Seedlings raised ...	1400	600	325	...	...	...	2325
<i>Coorg</i>							
Nullore Estate, Santicoppa							
P.O. Seeds supplied oz. ...	32	16	8	...	...	24	80
Seedlings raised ...	2000	1045	513	...	...	1710	5268
" distributed ...	958	940	1008	938	380	2337	6561
Madapur Estate, Madapur							
P.O. Seeds supplied oz. ...	32	16	8	...	...	24	80
Seedlings raised ...	600	300	200	...	...	400	1500
" distributed ...			350				350
<i>Malabar-Wynaad</i>							
Kottaram Estate, Kalpatta							
P.O. Seeds supplied oz. ...	32	16	8	...	...	24	80
Seedlings raised ...		1500				...	1500
Wynaad Colonization							
Scheme, Vatuvanchal							
P.O.							
Seeds supplied oz. ...	32	16	8	...	...	24	80
<i>Cochin</i>							
Govt. Fruit and Vegetable							
Farm, Sitharkunda P.O.							
Seeds supplied oz. ...	32	16	8	...	...	24	80
Seedlings raised ...	110	140	340	9	300	160	1059
" distributed ...	400	400	400	400	400	400	2400
<i>Nilgiri-Wynaad</i>							
Glenvans Estate, New Hope							
P.O. Seeds supplied oz. ...	32	16	8	...	...	...	56
Seedlings raised ...	1400	750	350	...	...	...	2500
" distributed ...		4500				...	4500
<i>Nilgiris</i>							
Adderly Estate, Coonoor P.O.							
Seeds supplied oz. ...	32	16	8	...	...	...	56
Seedlings raised ...		2700				...	2700
" distributed ...	...	370	45	...	110	...	525
<i>Coimbatore</i>							
Honnemetti Estate, Attikan							
P.O.							
Seeds supplied oz. ...	32	16	8	...	...	...	56
Seedlings raised ...	395	480	890	180	127	...	2072
" distributed ...	134	296	121	...	...	...	551
<i>Anamalais</i>							
Waterfall Estate, Attakatti							
P.O.							
Seeds supplied oz. ...	32	16	8	...	...	...	56
Seedlings raised ...	140	184	70	464	81	2000	2969
<i>Shevareys</i>							
Hawthorne Estate, Yercaud							
P.O.							
Seeds supplied oz. ...	32	16	8	...	...	24	80
Seedlings raised ...	200	250	100	115	75	2000	2740
" distributed ...	236	224	64	...	...	1840	2364
<i>Vishakhapatnam</i>							
Araku Valley Scheme,							
Araku P.O.							
Seeds supplied oz. ...	32	16	8	...	...	...	56

Note—Seeds were supplied free to all the nurseries except to those run by the Wynaad Colonisation and Araku Valley schemes. These two nurseries paid for the seeds.

II. CHEMISTRY

Manurial Experiments:

20. The permanent manurial experiments at Balehonnur and the co-operative manurial experiments in private estates in Mysore and Coorg started in 1939 were continued. The results of these experiments are furnished below :—

Permanent Manurial Experiments at Balehonnur (Mysore)

Annual rate of manuring :

N. (From 1941 to 1949) = 20 lb. per acre

N. (From 1950 . . .) = 40 lb. per acre

P₂O₅ = 30 lb. per acre

K₂O = 40 lb. per acre

Area of experimental block : 76 cents. Lay out : Latin square.

No. of plants per sub-plot : 5 x 8. Spacing : 5 ft. x 5 ft.

Variety : Kent's Arabica. Guard rows : One row all around the block.

TABLE IX—Yield Record of Permanent Manurials

YEAR	Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre.					Std. error express- ed as % of gen. mean	Critical differ- ence P=0.05	Signifi- cant or not	Conclusions										
	TREATMENTS																		
	N+P				CON- TROL														
	N	N+P	N+K	+K															
	A	B	C	D	E														
Ripe cherry																			
1941	„	...	791	663	918	918	553	21.8	513	No	<u>C,D,A,B,E</u>								
1942	„	...	1250	1207	1335	1360	740	11.8	436	Yes	<u>D,C,A,B,E</u>								
1943	„	...	60	89	113	85	43	17.9	16	Yes	<u>C,B,D,A,E</u>								
1944	„	...	255	213	306	264	204	19.0	147	No	<u>C,D,A,B,E</u>								
1945	„	...	1155	1132	1519	1744	736	26.9	1040	No	<u>D,C,A,B,E</u>								
1946	„	...	400	531	332	595	510	27.4	411	No	<u>D,B,E,A,C</u>								
1947	„	...	468	697	714	697	587	4.9	379	No	<u>C,D,B,E,A</u>								
1948	„	...	281	306	306	255	272	17.1	498	No	<u>B,C,A,E,D</u>								
1949	„	...	489	655	483	761	674	8.2	107	Yes	<u>D,E,B,A,C</u>								
„	Clean coffee	...	0.625	0.83	0.688	0.83	0.964	1.2	0.294	Yes	<u>E,D,B,C,A</u>								
1950	R.C.	...	1776	1836	1700	1734	1598	9.4	455	No	<u>B,A,D,C,E</u>								
„	Clean coffee	...	4.36	4.66	4.23	4.52	4.0	10.41	1.4	No	<u>B,D,A,C,E</u>								
1951	R.C.	...	562	396	540	273	229	22.02	270	Yes	<u>A,C,B,D,E</u>								
„	Clean coffee	...	0.891	0.602	0.821	0.396	0.330	23.65	0.442	Yes	<u>A,C,B,D,E</u>								
Average for 11 years										...	691	697	771	802	565	9.333	202	Yes	<u>D,C,B,A,E</u>

Considering the yields of cherry and clean coffee during 1951, treatments A and C i.e., N. only and N+K, have given yields which are significantly superior to Control 'No manure'. These results as usual with the other annual yields are by no means reliable. However from the analysis of the yields for the 11 year-period it is seen that D i.e., N+P+K and C (N+K) show significantly higher yields than Control (No manure). For the first time, treatment C has also become significantly higher than Control, but both of these (N+P+K and N+K) are not superior to N+P or N.

21. The analyses of the soil of sub-plots of the above experiment have given the following averages—

Nitrogen (N) in milligram per 100 grams, of soil

<i>Sub-Plot</i>	*	9-9"	9-18"
Control	...	249	195
N + P + K	...	239	193
N + K	...	257	196
A + P	...	231	215
N	...	244	202

The similarity of the figures both in the the 0-9" level and 9-18" level is highly significant. The addition of 10,000 lb of leaf mulch to simulate estate conditions has evidently brought about this result. It will be seen that this quantity of leaf mulch has added on an average 120 lb. nitrogen, 20 lb. phosphoric acid and 70 lb potash per acre per year, but in a slowly available form. These yearly additions have apparently swamped the effect of 20 lb. of nitrogen applied yearly upto 1949 and 40 lb. applied since 1950. It is now proposed to reduce the addition of leaf mulch to a mere 1000 lb. per year per acre prior to the dry weather to prevent undue drying of the soil.

Co-operative Manurial Experiments in Private Estates

SERIES I.

Annual rate of manuring

N (1940 to 1948)	=	20 lb. per acre.
N. (From 1949 Nov.)	=	40 lb. per acre
P ₂ O ₅	=	30 lb. per acre
K ₂ O	=	40 lb. per acre

Area of Experimental plot: 1.43 acres.

Layout: Latin square 5 x 5

Shade: Natural shade.

Variety: Kent's arabica

No. of plants per sub-plot:

Spacing: 6' x 6'

Gross 10 x 7.

Nett 8 x 5.

TABLE X—Results of co-operative manurial experiments
Experiment I—Santaweri Estate (Mysore)

YEAR	Average calculated yield of ripe cherry in lb. per acre					Standard error expressed as % of gen. mean	Critical differ- ence P=0.05	Signifi- cant or not	Conclusions	
	TREATMENTS									
	N	N+P	N+K	N+P +K	CON- TROL					
	A	B	C	D	E					
1940	...	1290	1440	1902	1110	2376	17.65	1170	No	<u>E,C,B,A,D</u>
1941	...	1260	1371	1908	1128	2286	13.04	639	Yes	<u>E,C,B,A,D</u>
1942	...	2166	2196	1794	1812	2658	12.78	839	Yes	<u>E,B,A,D,C</u>
1943	...	2352	2616	2664	2538	2580	9.79	769	No	<u>C,B,E,D,A</u>
1944	...	678	522	612	462	732	14.20	264	No	<u>E,A,C,B,D</u>
1945	...	2466	3348	2778	2941	2904	8.59	766	Yes	<u>B,D,E,C,A</u>
1946	...	3318	3432	3210	2418	2712	8.12	755	Yes	<u>B,A,C,E,D</u>
1947	...	2352	2460	2484	2520	2628	13.73	1106	No	<u>E,D,C,B,A</u>
1948	...	3702	4194	3420	3000	3636	17.64	1956	No	<u>B,A,E,C,D</u>
1949	...	714	732	738	492	720	16.25	341	No	<u>C,B,E,A,D</u>
1950	...	3702	3468	3666	4236	3330	7.13	808	Yes	<u>D,A,C,B,E</u>
1951	...	912	990	720	816	810	17.19	450	No	<u>B,A,D,E,C</u>
Average for 12 years	...	2077	2232	2209	2000	2282	10.79	257	Yes	<u>E,B,C,A,D</u>

The results have not been significant again this year. An examination of the year-wise yields shows such inconsistencies that it is apparent that no results can be obtained from such experiments on uneven material growing under natural conditions of shade.

TABLE XI—Experiment 2—Watekhan Estate (Mysore)

YEAR	Average calculated yield of ripe cherry in lb. per acre					Std. error express- ed as % of gen. mean	Critical differ- ence P=0.05	Signifi- cant or not	Conclusions
	TREATMENTS								
	N	N+P	N+K	N+P +K	CON- TROL				
	A	B	C	D	E				
1940	... 1686	1476	1620	1662	1428	11.14	541	No	<u>A,D,C,B,E</u>
1941	...	Results not recorded							
1942	... 930	708	978	672	696	13.15	333	No	<u>C,A,B,E,D</u>
1943	... 960	1422	1050	834	1116	12.17	553	No	<u>B,E,C,A,D</u>
1944	... 2244	1884	2352	2892	1950	10.79	750	Yes	<u>D,C,A,E,B</u>
1945	... 2406	2808	2688	2874	3618	12.41	1148	Yes	<u>E,D,B,C,A</u>
1946	... 3204	2988	3864	3648	2700	6.87	817	Yes	<u>C,D,A,B,E</u>
1947	... 4158	4224	3966	4014	4842	13.5	1637	No	<u>E,B,A,D,C</u>
1948	... 1710	960	866	936	936	11.14	933	No	<u>A,B,D,E,C</u>
1949	... 3936	4164	3858	4185	3516	8.6	1046	No	<u>D,B,A,C,E</u>
1950	... 1218	1272	1248	1290	1260	9.06	347	No	<u>D,B,E,C,A</u>
1951	... 1014	1776	1362	1518	1230	17.91	749	Yes	<u>B,D,C,E,A</u>
Average for 11 years	... 2230	2156	2109	2232	2134	5.58	3735	No	<u>D,A,B,E,C</u>

In this experiment, treatment B (N+P) has given significantly higher yields than A (N only) but when the 11-year average is taken, there is no significant difference between any of the treatments.

TABLE XII—Experiment 3—Kirgandur Estate (Coorg)

YEAR	Average calculated yield of ripe cherry in lb. per acre					Signi- ficant or not	Critical difference P=0.05	Conclusions
	TREATMENTS							
	N	N+P	N+K	N+P +K	CON- TROL			
	A	B	C	D	E			
1940	... 1362	1320	1242	1062	1362	No	416	<u>E, A, B, C, D</u>
1941	... 2562	2106	2286	2796	2124	No	1262	<u>D, A, C, E, B</u>
1942	... 1088	1020	1338	1008	846	Yes	430	<u>C, A, B, D, E</u>
1943	... 1368	1818	1566	1608	1542	No	528	<u>B, D, C, E, A</u>
1944	... 5076	5724	5712	4056	4860	No	1286	<u>B, C, A, E, D</u>
1945	... 4914	3948	3900	4188	3906	Yes	992	<u>A, D, B, E, C</u>
1946	... 3595	3912	4189	3269	3707	No	852	<u>C, B, E, A, D</u>
1947	... 3408	3132	4080	4672	3366	No	912	<u>D, C, A, E, B</u>
1948	... 366	606	330	276	300	Yes	242	<u>B, A, C, E, D</u>
1949	... 4464	4650	3862	4386	4260	No	922	<u>B, A, D, E, C</u>
1950	... 3306	3292	3233	3455	3364	No	1395	<u>D, E, A, B, C</u>
1951	... 7512	7296	6372	5028	5454	No	3713	<u>A, B, C, E, D</u>
Average for 12 years	... 3252	3235	3176	2984	2924			

There is no significant difference in 1951 nor in 9 out of 12 years. There is no significant difference in the averages as well. It is proposed to abandon the experiment as from the next season.

TABLE XIII—Experiment 4—Gargandur Estate (Coorg)

YEAR	Calculated yield of ripe cherry in lb. per acre					Signi- ficant or not	Critical diffe- rence P=0.05	Conclusions
	TREATMENTS							
	N	N+P	N+K	N+P +K	CON- T OL			
	A	B	C	D	E			
1940	... 979	937	1047	1211	709	Yes	407	<u>D, C, A, B, E</u>
1941	... 1924	1802	2103	2572	2700	No	929	<u>E, D, C, A, B</u>
1942	... 2132	1792	2338	2669	1707	No	1086	<u>D, A, C, E, B</u>
1943	... 1291	401	564	378	899	No	735	<u>A, E, C, B, D</u>
1944	... 2814	3492	4200	4248	3294	No	1092	<u>D, C, B, E, A</u>
1945	... 2148	1494	1956	1428	2070	No	920	<u>A, E, C, B, D</u>
1946	... 2279	2345	3279	2571	2474	No	1010	<u>C, D, E, B, A</u>
1947	... 2742	2580	3120	2724	2970	No	468	<u>C, E, A, D, B</u>
1948	... 126	90	78	54	72	No	83	<u>A, B, C, E, D</u>
1949	... 3174	3204	3112	3254	3252	No	608	<u>D, E, B, A, C</u>
1950	... 1632	2082	1777	1962	2073	No	479	<u>B, E, D, C, A</u>
1951	... 4902	4524	4638	5196	5100	No	1362	<u>D, E, A, C, B</u>
Average for 12 years	... 2179	2062	2351	2356	2277			

The 1951 results show no significant difference between treatments. There was no response to manuring except in 1940 when treatment D (N+P+K) was superior to treatment E (Control). The 12-year averages do not show any significant difference between treatments.

SERIES II

22. **Bulky v. concentrated manures.** There is only one experiment to report on under this series during the current year. The results of the other experiment at Boothanhadloo (Coorg) are not available as the staff of the estate had picked the crop without notice.

Locality: Netraconda (Mysore)

Annual rate of manuring :—

N. = 20 lb. per acre.
 P_2O_5 = 30 lb. per acre.
 K_2O = 40 lb. per acre.

Area of experimental plot: 1.83 acres.

Layout: Latin square 4 × 4.

No. of plants per sub-plot:—

Shade: Natural shade.

Gross: 13 × 11.

Nett: 11 × 9.

Spacing: 6' × 6'.

Treatments :

(A) ($\frac{1}{2}$ bulky + $\frac{1}{2}$ concentrated nitrogen) — Compost to provide 10 lb. nitrogen and the balance of 10 lb. of nitrogen as a mixture of ground-nut oil-cake and ammonium sulphate *plus* enough superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O respectively.

(B) (Bulky nitrogen) — Compost to provide 20 lb. nitrogen *plus* sufficient superphosphate *plus* sulphate and muriate of potash (in equal quantities to provide 30 lb. P_2O_5 and 40 lb. K_2O respectively).

(C) (Concentrated Nitrogen) — 15 lb. nitrogen as ground-nut oil-cake and 5 lb. of nitrogen as ammonium sulphate *plus* superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O .

(D) Control — (No manure).

TABLE XIV—Results of bulky v. concentrated manures,
Netraconda Estate (Mysore)

YEAR		Average yield of ripe cherry in lb. and clean coffee in cwt. per acre				Stand- ard er- ror ex- pressed as % of	Critical differ- ence P=0.05 gen. mean	Signi- ficant or not	Conclusions
		TREATMENTS							
		A	B	C	D				
1940	Cherry	424	596	549	502	18.45	394	No	<u>B, C, D, A</u>
1941	„	900	882	824	888	38.33	579	No	<u>A, D, B, C</u>
1942	„	748	743	867	703	28.69	763	No	<u>C, A, B, D</u>
1943	„	112	111	115	173	40.54	183	No	<u>D, C, A, B</u>
1944	„	615	636	712	667	17.73	403	No	<u>C, D, B, A</u>
1945	„	1140	1206	1335	1381	10.74	1484	No	<u>D, C, B, A</u>
1946	„	1967	1624	1254	1318	15.56	932	No	<u>A, B, D, C</u>
1947	„	909	1041	1123	902	9.63	332	No	<u>C, B, A, D</u>
1948	„	152	224	127	143	15.11	86	No	<u>B, A, D, C</u>
1949	„	1830	1767	1879	1860	10.31	447	No	<u>C, D; A, B</u>
	„ Clean coffee	2.54	2.71	2.84	3.0	8.99	1.14	No	<u>D, C, B, A</u>
1950,	cherry	1212	1169	1206	1153	15.98	655	No	<u>A, C, B, D</u>
	„ Clean coffee	1.9	1.78	1.84	1.76	30.53	0.938	No	<u>A, C, B, D</u>
1951	cherry	521	635	660	300	17.09	343	No	<u>C, B, A, D</u>
	„ Clean coffee	0.82	1.015	1.044	0.771	18.14	0.573	No	<u>C, B, A, D</u>
Average for 12 years									
Ripe cherry		778	887	887	851	9.67	284	No	<u>C, B, D, A</u>

There is no response to manure even in 1951 nor in the averages of the yields for 12 years. It has been pointed out in the previous report that the amount of leaf mulch that is being added by the shade trees provide enough plant food to produce a more or less average crop in all

the plots and that the small amount of fertilisers and bulky manures added have not produced any increase in yields.

23. **Catalyzation of plant nutrients:** In co-operation with the Biochemistry Department of the Indian Institute of Science Bangalore, two experiments were laid out in 1948—one at each Research Station—to test the effect of certain catalysts on the availability of manures applied. The first application of manures was done in June 1948. The results are furnished below—

EXPERIMENT I

Locality: L-1 block of the Coffee Research Station, Balehonnur.

Annual rate of manuring: (a) N = 20 lb. per acre till 1949 and 40 lb. thereafter in the form of g.n. cake : am. sulphates : 3; 1.
 P_2O_5 = 30 lb. per acre, as superphosphate or steamed bonemeal.
 K_2O = 40 lb. per acre as cherry husk ash.

In addition certain catalysts (certain chemicals in very fine state of sub-division) are added to the sub-plots according to treatment.

Area of Expl. plot: = 1.43 acres. *Layout:* Latin square 5 × 5

Variety: Kent's arabica No. of plants per sub-plot

Shade: Natural shade *Gross:* 10 × 7

Nett: 8 × 5

Spacing: 6 ft. × 6 ft.

Treatments:

A.—Proprietary Product A

B.—Proprietary Product B

C.—Ferrous sulphate

D.—Potassium permanganate

E.—Control (No catalyst added)

General manurial mixture containing 40 lb. N., 30 lb. P_2O_5 and 40 lb. K_2O (per acre of 1,200 plants) to all the sub-plots.

TABLE XV—Results of catalyzed manures experiment

YEAR	Average yield of ripe cherry in lb. & clean coffee in cwt. per acre.					Standard error expressed as % of gen. mean	Critical difference P=0.05	Signifi- cant or not	Conclu- sions.
	TREATMENTS								
	A	B	C	D	E				
1949, Cherry...	498	504	456	480	480	49.1	74	No	<u>B, A, D, E, C.</u>
„ Clean coffee.	0.813	0.893	0.508	0.732	0.758	18.05	0.41	No	<u>B, A, E, D, C</u>
1950, cherry.	672	624	498	798	558	19.21	374	No	<u>D, A, B, E, C</u>
„ Clean coffee.	0.929	0.804	0.696	1.000	0.732	20.93	0.545	No	<u>D, A, B, E, C</u>
1951, cherry.	744	780	678	816	816	19.14	753	No	<u>D, E, B, A, C</u>
„ Clean coffee.	1.112	1.112	0.952	1.113	1.112	18.83	0.629	No	<u>D, A, B, E, C</u>
Average for 3 years ripe cherry.	654	662	512	712	616	14.50	282	No	<u>D, B, A, E, C</u>

Treatments have not been significant. Ferrous sulphate appears to depress the yields for the past two seasons and in the averages of 3 years. However treatment D (Potassium permanganate) has given numerically superior yields to all the treatments and control.

EXPERIMENT II

Locality: Coffee Research Station,
Chethalli.

Variants: 5 as noted in the table.

Layout: 5 x 5 latin square

Variety: Arabica (Coorg) planted about 20 years back.

Area of sub-plot: Gross: 10 x 7

Nett: 8 x 5 plants.

Shade: Natural shade.

TABLE XVI—Results of catalyzed manures experiment—Chethalli (Coorg)

No.	Symbol	Treatments (per acre)	Ripe cherry in lb. per acre		Clean coffee in cwt. per acre	
			1950	1951	1950	1951
1	A.	28 lb. Ferrous sulphate	1685	3012	3.00	4.48
2	B.	20 lb. Potassium permanganate	1330	2424	2.38	3.61
3	C.	40 lb. Catalyst product	1436	2844	2.56	4.23
4	D.	80 lb.	744	1986	1.33	2.96
5	E.	Control—No catalyst	1538	2658	2.75	3.96
		Mean.	1347	2585	2.4	3.85
		Significant or not	No	No	No	No
		Critical difference in lb. per acre.	1231	775		1.15
		S.E.M. %	29.50	9.74	29.50	11.25
		Conclusions	A, E, C, B, D A, C, E, B, D A, E, C, B, D A, C, E, B, D			

(The regression of yield on the number of plants in the different plots for the year 1951, is not significant).

There is no significant difference between the treatments. The higher dose of catalysts has apparently depressed the yields, but it misses significance.

24. Lights in relation to manurial treatments. During the harvest of the manurial plots at Balehonnur and the two private estates—Santaweri and Watekhan—the float contents of the produce were determined. The results are tabulated below:—

TABLE XVII—Percentage of floats in Manurial treatments

TREATMENT & YEAR	Permanerit Manurials Balehonnur		Bulky v. Con- centrated Balehonnur		Catalyzed ma- nure expt. Balehonnur		Co-operative manurials	
							Santa weri	Wate- khan
	By Weight	By Volume	By Weight	By Volume	By Weight	By Volume	By Weight	By Weight
A (N. only):—								
1949	5.4	3.62					2.0	2.0
1950	7.31	8.35					1.66	2.98
1951	6.21	3.91					5.998	2.69
B (N+P)								
1949	3.8	2.91					1.8	2.0
1950	8.7	9.42					1.72	4.09
1951	6.77	3.58					4.674	2.36
C (N+K)								
1949	8.0	5.77					1.8	1.8
1950	7.29	7.98					2.09	3.67
1951	4.52	3.02					5.212	2.82
D(N+P+K)								
1949	9.8	6.51					1.2	2.2
1950	7.9	9.29					2.08	4.25
1951	6.44	4.39					5.086	3.22
E (Control)								
1949	5.4	7.02					1.8	2.6
1950	8.83	9.19					2.42	6.2
1951	5.02	3.05					6.978	2.99
F (Bulky)								
1949			3.75	2.59				
1950			3.64	3.48				
1951			2.93	3.22				
G (Conc)								
1949			3.5	4.40				
1950			4.6	3.92				
1951			2.56	3.53				
H ($\frac{1}{2}$ Bulky + $\frac{1}{2}$ Conc)								
1949			5.0	3.35				
1950			3.38	3.28				
1951			3.04	4.07				
I (Control)								
1949			4.25	3.87				
1950			4.16	4.03				
1951			2.21	3.83				
J (P. Product A)								
1949					12.21	10.36		
1950					8.40	9.37		
1951					6.15	5.63		
K (P. Product B)								
1949					10.71	7.95		
1950					8.00	8.9		
1951					5.44	5.28		
L (Ferrous sulphate)								
1949					11.61	9.15		
1950					9.28	10.48		
1951					4.62	4.49		
M (Pot permanganate)								
1949					10.71	9.81		
1950					5.86	6.88		
1951					5.83	5.2		
N (Control)								
1949					10.56	11.23		
1950					7.73	9.07		
1951					6.29	5.91		

The results have not been significant. It appears that the occurrence of *floats* in the manurial experiments varies from year to year and is therefore due to seasonal factors.

25. **Fundamental manurial trials at Balehonnur.** The fundamental manurial experiment started in 1949 in accordance with the recommendations of the Expert Committee to study the effect of varying plant nutrients on the growth of coffee, is continued. No liming was done as the pH of the soil from the 36 cisterns ranged round pH 7. Periodical observations on the growth of the plants are being maintained. Soil samples are being taken periodically (1) before application of manures in May and (2) after the monsoon and before the second application of nitrogenous manures in post-monsoon period to assess the proportion of plant foods used by coffee and that lost by leaching. Analyses of these samples showed that most samples ranged round 0.17 per cent nitrogen. The scheme of this experiment is furnished below—

EXPERIMENT

<i>Locality:</i>	Coffee Research Station, Balehonnur.
<i>Variety:</i>	Arabica (clones from S. 31).
<i>Treatments:</i>	6.
<i>Size of each cistern:</i>	6' × 6' = 36 sq. ft.
<i>Replications:</i>	6. Area of Experimental plot: 3 cents.
<i>Units:</i>	Single plant.
<i>Shade:</i>	Artificial (coir netting).
<i>Layout:</i>	Latin square 6 × 6.

Manurial scheme

<i>Treatments</i>		<i>Pounds per acre.</i>		
		N.	P ₂ O ₅	K ₂ O
1.	...	20	30	40
2.	...	30	30	40
3.	...	45	30	40
4.	...	30	45	40
5.	...	30	45	60
6.	...	45	67.5	90

Nitrogen is given half as groundnut oil-cake and half as ammonium sulphate. Half the nitrogen is applied pre-monsoon and half post-monsoon. Phosphoric acid and potash are given pre-monsoon mixed with the nitrogenous manure and applied in the form of a ribbon all round the plant. Phosphoric acid is given in the form of steamed bonemeal and potash in the form of muriate of potash.

26. **The influence of potash on bean quality and yield.** This experiment was started at Chethalli sub-station in 1948. The first application of manures was made in April 1948. The results are furnished below:

<i>Locality:</i>	Coffee Research sub-station, Chethalli (Coorg)		
<i>Variants:</i>	4.	<i>Layout:</i>	4 × 4 Latin square.
<i>Variety:</i>	Arabica (Coorg).	<i>Area of each plot—</i>	6 × 3 plants, About 20 yrs. old. 1½ cents.
<i>Shade:</i>	Natural shade.		

TABLE XVIII—Influence of potash on Bean quality

No.	Symbol	Treatment	Yield per acre				percentage of	
			Ripe cherry in lb.		Clean coffee in cwt.		floats per treatment	
			1950	1951	1950	1951	1950	1951
1	A	40 lb. K ₂ O	2484	1667	4.44	2.48	2.95	4.5
2	B	60 lb. do	2163	1767	3.87	2.63	2.77	4.2
3	C	90 lb. do	1907	2300	3.40	3.42	2.23	3.3
4	D	Control-No potash.						
		Only 40 lb. N + 30 lb. P ₂ O ₅	2767	1784	4.94	2.65	2.40	4.1
		Mean:—	2330	1884	4.16	2.80	2.56	4.0
		Significant or not.	No		No	No	No	No
		Critical difference	1023	1094		1.63	1.39	2.1
		S.E. Mean %	12.93	16.94	12.93	16.94	15.70	10.50
Conclusions			D,A,B,C		C,D,B,A		C,D,B,A	
							A,B,D,C	

The results show no significant difference. It is proposed to terminate this experiment as advised by the Expert Committee.

27. **Manurial experiments on robusta.** A small-scale experiment was started during the year to find out the effect of application of complete fertilizer, with two variants of nitrogen on robusta plants of over twenty years old. The experiment was laid out in randomized plots replicated 6 times. Lime at one ton per acre was applied to all the plots in March as a basal dressing. Applications of manure as detailed below were made early in June—

Treatments:

	N.	P ₂ O ₅	K ₂ O	Remarks
A.	40 lb.	30 lb.	40 lb.	Manures will be applied every year. N half as groundnut cake and half as ammonium sulphate. P ₂ O ₅ as bonemeal and K ₂ O as muriate of potash.
B.	80 lb.	30 lb.	40 lb.	
C.	No manure (Control).			

Nitrogenous manure was applied broadcast along the drip circle of the plant, potash and phosphoric acid in furrows 6 inches deep opened between plant rows. The experiment will be continued for a period of 5 years in the first instance. Observations will be recorded for vigour of growth, shoot and spike production, earliness or lateness in flowering, *jollu* content and fruit production in all the treatments.

28. **Erythrina Lithosperma (Dadap) pruning experiment.** An experiment to study the release of nitrogen from the root nodules of *Erythrina lithosperma* plants consequent to lopping of branches has been laid out. The experiment consists of three treatments: (A) Control, (B) Completely lopping all branches and (C) lopping all branches except three leaders having a bunch of leaves at the ends. The treatments are replicated 6 times and are laid out as a randomized block. Soil samples to a depth of 0.9" and 9.18" from around the experimental plants and sample roots having root nodules on them have been collected before applying the treatments. Such samples are being collected every fortnight and are being analysed for their nitrogen content, the number of nodules and their condition. The experiment is in progress.

29. **Laboratory work.** Work in the laboratory consisted mainly of routine analysis of soil and manure samples sent by planters and those collected by the department. The four soil profiles collected from Chethalli sub-station were analysed by drawing samples from every 3 inches of the profile. In order to investigate the probable cause of the abnormal leaf and fruit fall that occurred at the end of the S.W. rains, healthy as well

TABLE XIX—Analyses of soil profiles collected from Chethalli sub-Station (Coorg)

PERCENTAGE ON AIR—DRY BASIS												
Description of soil sample	1	2	3	4	5	Phosphoric acid		Organic carbon	Insoluble Residue SiO_2	10 $\frac{\text{R}_2\text{O}_3}{(\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)}$	11 $\frac{\text{SiO}_2}{\text{R}_2\text{O}_3}$	Total CaO
						Total P_2O_5	Available P_2O_5 mgms					
<i>Soil Profile I</i>												
10-acre block	0-3"	2.33	6.32	0.098	0.03	0.016	—	0.734	72.8	24.53	2.969	0.464
	3-6"	2.22	6.4	0.093	0.064	0.019	2.8	0.858	71.9	25.39	2.833	0.421
	6-9"	1.72	7.2	0.071	0.047	0.042	1.936	0.824	73.0	29.85	2.445	0.450
	9-12"	2.06	6.63	0.123	0.047	0.017	6.384	1.121	68.6	25.90	2.649	0.450
	12-15"	2.13	6.73	0.152	0.017	0.025	1.236	1.430	74.8	24.42	3.063	0.529
	15-18"	1.6	8.71	0.122	0.022	0.068	1.647	2.61	79.3	15.32	5.176	0.442
	18-21"	1.78	9.73	0.191	0.034	0.069	2.677	3.316	69.0	15.92	4.333	0.565
<i>Soil Profile II</i>												
Top or Meda-thana block	0-3"	3.66	6.39	0.118	0.6501	0.024	1.856	0.449	69.6	33.83	2.057	0.268
	3-6"	3.11	6.25	0.080	0.595	0.073	18.56	0.481	74.8	15.73	4.755	0.370
	6-9"	2.23	6.15	0.096	0.655	0.065	2.268	0.634	74.1	16.06	4.614	0.435
	9-12"	2.71	5.26	0.106	0.408	0.035	2.884	0.948	75.3	19.43	3.884	0.391
	12-15"	2.38	7.00	0.204	0.506	0.042	2.678	1.474	75.6	15.44	4.896	0.508
	15-18"	2.88	8.76	0.266	0.289	0.064	5.974	2.685	75.7	13.47	5.522	0.522
	18-21"	3.04	9.51	0.309	0.285	0.051	3.914	3.648	77.2	12.43	6.211	0.638
<i>Soil Profile III</i>												
Kadanga block-	0-3"	4.68	5.59	0.100	0.591	0.042	0.0412	0.692	70.7	21.71	3.256	0.305
	3-6"	4.3	7.11	0.104	0.587	0.033	0.0412	0.815	65.5	19.57	3.347	0.348
	6-9"	4.02	6.14	0.112	0.582	0.038	0.165	1.133	67.1	21.5c	3.113	0.311
	9-12"	2.71	7.3	0.128	0.531	0.054	0.412	1.214	67.4	23.90	2.332	0.326
	12-15"	3.45	7.8	0.201	0.366	0.051	0.618	1.974	73.6	21.80	3.376	0.348
	15-18"	3.18	7.57	0.209	0.459	0.073	1.647	2.084	74.6	15.83	4.433	0.391
	18-21"	3.02	9.73	0.269	0.259	0.047	1.647	3.543	73.2	17.05	4.294	0.493
<i>Soil Profile IV</i>												
Virgin soil	0-3"	5.57	6.31	0.061	0.047	0.017	5.769	0.137	63.8	21.43	2.977	0.609
	3-6"	5.92	6.2	0.066	0.081	0.013	7.009	0.212	61.0	22.04	2.768	0.508
	6-9"	5.53	7.03	0.074	0.089	0.018	6.18	0.180	59.4	23.28	2.552	0.435
	9-12"	4.92	7.85	0.089	0.191	0.047	2.884	0.449	57.9	29.50	1.963	0.493
	12-15"	4.72	7.40	0.146	0.191	0.061	13.18	1.206	66.8	19.89	3.358	0.406
	15-18"	4.29	7.77	0.180	0.291	0.078	2.882	1.68	68.0	19.87	3.422	0.602
	18-21"	4.49	11.27	0.296	0.357	0.093	8.443	4.27	67.1	16.56	4.052	0.805

as the apparently healthy leaves which dropped out on shaking the coffee plants were collected and analysed. The work on the analysis of shade tree leaves continued. The results of these analyses are tabulated below.

Comments :

Moisture. Soil Profile I is poor in moisture holding capacity and soil profile II is also not good. The soil appears to have deteriorated as can be seen by comparison with virgin soil (Soil Profile IV).

Loss on Ignition. There is a slight reduction in the figures for this factor in all the three profiles from the cultivated areas as compared with the virgin soil.

Total Nitrogen. Soil Profile I shows total nitrogen practically on the margin of a very poor soil. Cultivation and manuring appear to have improved Profiles II and III.

Total K_2O . The original soil appears to have a good potash content (about 0.3%). Soil Profile I appears to have lost practically all the potash.

Total phosphoric acid. All the profiles show very low P_2O_5 .

Available phosphoric acid. All the three cultivated profiles show much poorer available P_2O_5 than the profiles from virgin soil. This shows that there has been a change in the colloid complex following cultivation.

SiO_2/R_2O_3 Ratio. Except in profile II, the lowest SiO_2/R_2O_3 ratio is to be found in the 9-12" depth of soil thus denoting that accumulation of R_2O_3 is taking place at that depth and that the upper layers are being leached out of these oxides. In the case of soil profile IV the ratio denotes laterite formation. It is likely that pan formation may start at this depth very soon suggesting poor drainage in the sub-soil. Otherwise the soils are all friable and except for the 0-12" layer of soil profile I, all are loamy.

CaO. The soil profiles show good CaO content.

Organic carbon. Except soil profile III, all the soils show low organic carbon upto a depth of 0-12".

30. The following table gives the analysis of leaves which had fallen from coffee plants which were green and apparently healthy and of those that were plucked from the plants. This leaf-fall occurs usually after a wet spell and was first noticed in the Bababudangiris. Complaints about abnormal leaf fall of this type are being received now from all over the coffee areas. The following are the results of the analyses of two sets of leaf-samples obtained from Coorg.

TABLE XX

PERCENTAGE ON AIR-DRY BASIS								
SAMPLE	Mois- ture	Loss on ignition	Organic carbon	Total Nitro- gen	Total K_2O	Total P_2O_5	Insolu- ble Residue SiO_2	C/N
<i>Nettley Yemmegondi</i>								
<i>Estate — Healthy</i>								
leaf (plucked) ...	9.92	82.91	36.86	2.536	2.302	0.379	5.518	14.53
Fallen ...	8.34	90.01	36.31	3.474	2.395	0.475	1.091	10.45
<i>Attur Estate—</i>								
<i>Healthy leaf</i>								
(plucked) ...	8.95	87.66	42.59	2.629	2.018	0.370	2.472	16.20
Fallen ...	7.82	89.10	42.95	3.306	2.048	0.446	1.974	12.99

It will be noticed that in the fallen leaves there is a greater accumulation of nitrogen and phosphoric acid and the C/N ratio is much lower in the fallen leaves denoting a stage of ripeness. The insoluble residue (SiO_2) is very much lower in the fallen leaves than in the healthy ones.

31. **Plant foods from leaves of shade tree.** The analysis of leaves which drop from shade trees commonly found in the coffee estates of Mysore was continued. The following table gives the results of the analysis carried out, along with those done last year.

TABLE XXI — Analysis of Shade Tree Leaves

SHADE TREE	% On air-dry basis			% On oven-dry basis						
	Moisture	Loss on ignition	Ash	Insoluble residue	Nitrogen	Potash K ₂ O	Phosphoric acid P ₂ O ₅	Calcium oxide (Lime) CaO	Carbon	C/N
1. <i>Erythrina lithosperma</i> (Dadap)	7.75	82.5	3.5	6.40	2.245	1.188	0.234	2.911	43.91	19.56
2. <i>Erythrina tomentosa</i>	6.36	62.03	12.8	5.65	1.789	0.672	0.114	1.289	38.2	21.35
3. <i>Albizzia lebbek</i> (Kalbage)	7.36	67.36	25.28	1.65	1.965	0.532	0.242	2.374	27.95	14.22
4. <i>Pterocarpus marsupium</i> (Honne)	9.05	62.98	7.44	0.78	1.706	1.01	0.116	0.645	33.71	19.76
5. <i>Dalbergia latifolia</i> (Beete)	7.42	36.16	6.42	0.5	2.181	0.156	0.175	5.083	30.38	13.93
6. <i>Ficus tsiela</i> (Bilibasari)	11.1	73.8	15.1	3.96	1.209	0.722	0.342	3.367	40.57	33.57
7. <i>Ficus retusa</i> (Mirtlee — Chengoni)	6.36	83.6	9.24	1.76	0.819	0.494	0.144	2.766	40.96	50.01
8. <i>Ficus glomerata</i> (Atti)	13.22	69.44	12.74	6.76	1.140	0.635	0.345	3.548	34.43	30.21
9. <i>Ficus mysorensis</i> (Goni)	8.03	43.17	19.96	4.67	1.08	2.80	0.319	0.941	40.51 ^a	37.52
10. <i>Ficus nexarsa</i> (Neeru Basari)	9.03	56.36	20.39	13.53	1.023	0.43	0.108	2.172	34.57	33.8
11. <i>Ficus tiakela</i> (Kari Basari)	9.39	65.61	16.57	2.97	1.375	1.075	0.192	0.514	39.43	28.67
12. <i>Ficus callosa</i> (Anapija)	8.28	49.34	24.52	18.71	1.177	1.87	0.38	2.085	27.94	23.73
13. <i>Artocarpus integra</i> (Halasu)	9.26	67.52	23.22	15.93	1.175	0.739	0.128	2.433	34.67	29.5
14. <i>Artocarpus hirsuta</i> (Hebbahalasu)	11.52	71.88	13.18	1.94	1.346	0.265	0.152	1.607	33.98	25.24
15. <i>Eugenia jambolana</i> (Nerale)	9.58	86.1	4.32	0.32	0.804	0.752	0.139	1.390	41.08	54.6
16. <i>Bischofia javanica</i> (Neerale, Netrike, Gobbaraneralu, Neeli)	11.00	80.6	8.4	2.64	1.141	1.212	0.229	1.405	40.74	35.71
17. <i>Grevillea robusta</i> (Silver oak)	7.53	84.4	8.07	23.8	1.184	0.561	0.128	2.085	39.3	33.2
18. <i>Terminalia bellerica</i>	8.8	80.3	40.9	2.82	1.623	0.783	0.245	3.866	40.88	25.19
19. <i>Maesopsis eminii</i>	7.66	83.2	4.57	1.64	1.889	0.258	0.102	3.484	30.94	16.38
20. <i>Cedrela toona</i> (Gandhagarige—Red cedar).	8.46	79.26	5.56	2.54	2.309	0.227	0.280	1.535	39.42	17.07

Comments :

Nitrogen. The trees belonging to leguminosae show a high percentage of nitrogen. However three others which do not belong to this natural order, namely, *Terminalia bellerica*, *Maesopsis eminii* and *Cedrela toona* also show high nitrogen content in their leaves.

C/N ratio. *Dalbergia latifolia* and *Albizia lebbek* have a very low C/N ratio as compared with others. The C/N ratio of these trees is just about double that of humus suggesting that a more rapid break-down to humus of their leaves is probable and possible than with others.

K₂O. *Ficus mysorensis* and *Ficus callosa*, both thick-leaved trees, show a high K₂O content. *Dalbergia latifolia*, *Artocarpus hirsuta*, *Maesopsis eminii* and *Cedrela toona* have all K₂O content less than 0.3 per cent.

P₂O₅. *Dalbergia latifolia* is outstanding in that the P₂O₅ in its leaves is about three to five times that found in others. *Ficus nervosa* and *Maesopsis eminii* have the lowest P₂O₅ content.

CaO. *Dalbergia latifolia* shows the highest CaO content whilst *Ficus tjakela* shows the lowest.

Insoluble residue—SiO₂. *Grevillea robusta*, *Ficus callosa*, *Artocarpus integra* and *Ficus nervosa* have all high SiO₂ content. *Dalbergia latifolia* and *Eugenia jambolana* have the lowest.

Of all the shade trees *Erythrina lithosperma*, *Albizia lebbek*, *Dalbergia latifolia*, *Ficus tsiela*, *Ficus mysorensis*, *Ficus glomerata*, *Ficus callosa*, *Artocarpus integra*, *Eugenia jambolana*, *Bischofia javanica*, *Grevillea robusta*, *Terminalia bellerica* and *Maesopsis eminii* appear to have a fair proportion of N, P, K, Ca and Si. Other factors like quantity of leaf mulch that falls under each variety, rooting habits, the leaf shedding and reclothing sequences and host relationships with insect and plant pests must be taken into consideration before deciding the types of shade trees to be planted in any clearing. It is self evident that no single type of shade tree will satisfy all the conditions required of shade, and planting of mixed shade is a very safe and appropriate measure.

III. AGRONOMY

31. The following were the agronomic investigations conducted at Balehonnur and at Chethalli:—

1. Effect of pruning on yields.
2. The relative merits of bed and basket plants.
3. The effect of early pitting and late pitting on planting.
4. The effect of time of transplanting seedlings from germination beds to baskets.
5. The study of basic yields for standardisation of experimental plots.
6. Rejuvenation experiments on old coffee.
7. Single v. multiple stem of growing coffee.
8. The use of plant hormones for preventing fruit-drop.
9. The effect of weed-killers.
10. Seed germination tests.
11. Mulching experiment.
12. Vegetative propagation.

32. **The effect of pruning on yields:** The results of experiments started in 1946 are furnished below:—

<i>Locality:</i> Ghattadhulla (Coorg).	<i>Layout:</i> Latin square 5 x 5
<i>Area of Exptl. plot:</i> 2.71 acres	<i>Area of each sub-plot:</i>
<i>Variety:</i> Arabica (Coorgs)	<i>Nett</i> 10 x 10 or 100 plants
<i>Shade:</i> Natural shade.	(1/12 acre).
<i>Variants:</i> 5.	

Treatments: A—Light hot weather prune. D—Medium monsoon prune.
 B—Light monsoon prune. E—Control—no prune.
 C—Medium hot weather prune.

TABLE XXII—Effect of pruning on yields

TREATMENTS	LEAF COUNTS					Yield of ripe cherry in lb. per acre							
	Sep. 1946	Sep 1947	Sep. 1950	Feb. 1946	Feb. 1947	Feb. 1948	Feb. 1950	Feb. 1951	1946	1947	1948	1950	1951
A.	49.7	25.8	49.3	24.0	13.2	23.1	18.2	23.3	1346	2706	1754	1834	2267
B.	44.2	23.7	50.9	28.6	13.1	23.6	22.0	26.7	1224	2530	1782	1889	2520
C.	38.1	25.8	46.8	23.9	15.4	24.5	24.9	22.3	1020	3196	1686	1812	2253
D.	50.8	29.4	51.9	32.4	14.2	23.0	23.5	23.7	938	2652	2176	1915	2053
E.	47.4	25.3	49.5	25.2	13.2	22.6	18.3	22.3	1510	2708	2285	1509	2453
Gen. Mean	46.0	25.0	49.7	26.8	13.8	23.4	21.4	23.6	1208	2758	1937	1759	2293
Sig. or not	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	No	No	No
Std. error	9.37	10.24	8.62	10.34	4.96	3.95	9.39	8.32	10.70	12.11	20.30	18.47	6.91
Crit. diff.	12.6	8.3	13.2	8.1	2.0	2.7	6.2	5.9	378	975	1164	932	733
Conclusions	DAEBC	DACEB	DBEAC	DBEAC	CDAEB	CBADE	CDBEA	BDACE	EA $\overline{B}$ CD	CAEDB	CBADE	DBCAE	BEACD

There are no significant differences except in the year 1946 among the four methods of pruning, but none of them happens to be superior to Control (no prune).

33. **The relative merits of bed and basket plants:** This trial was started in 1949-50 to study the relative merits of bed and basket plants in respect of their growth and survival values. Two plots of 10 cents each were marked—one for each of the selections S. 288 and S. 645. Half of each strip was planted to 15-month old bed plants in July 1949 while the other half was planted in September 1949 to 5-month old basket plants. Though the bed plants were nearly 11 months older than the basket plants at the time of planting, the difference was hardly distinguishable at the end of June 1951.

34. **The effect of early pitting and late pitting on planting:** This experiment was also started in 1949-50 to determine the effect of early pitting and late pitting on the growth of seedlings;—

LAYOUT: Randomized block.

Replications: 6.

Plot: 16 x 4 plants.

Spacing: 6½' x 6½'

Selection: S. 795.

Locality: Coffee Research sub-station, Chethalli (Coorg)

Treatments: A.—Early pits opened on 8th and 9th July 1950.

B.—Late pits opened on 8th, 9th and 10th August 1950.

Pits closed on 14, 16 and 17th August 1950.

The interval between early pitting and late pitting was only one month and no apparent difference was noticed.

35. The study of basic yields for standardization of experimental plots: The replicated experiment laid out in July 1949 for the purpose of finding out the most suitable method of soil management in old coffee was continued. The basic yields of the plots are furnished below :—

Locality: Chethalli (Coorg). *Area of each plot:*
Layout: 6 × 6 latin square. *Gross:* 16 × 10 plants.
Variants: 6. *Nett:* 14 × 8 plants.
Variety: Arabica (Coorgs). *Shade:* Natural mixed shade
Age: About 20 years.

TABLE XXIII—Cultivation experiments (Standardization of plots)

No.	SYMBOL	TREATMENT	Yield per acre		Calculated yield of clean	
			Ripe	cherry in lb.	coffee in	cwt. per acre
			1950	1951	1950	1951
1.	A.	Trenching 1½ ft. deep	711	1362	1.26	2.43
2.	B.	—do— ¾ ft. deep	813	1040	1.45	1.86
3.	C.	Renovation pitting	618	1004	1.10	1.79
4.	D.	Light digging	488	856	0.87	1.71
5.	E.	Heavy digging	588	810	1.05	1.45
6.	F.	Control (only removing weeds)	569	1395	1.01	2.40
		Mean	631	1078		
		Critical difference	464	754		1.35
		S.E. Mean %	24.9	23.7		
		Conclusions	... B,A,C,E,F,D		F,A,B,C,D,E	

The results indicate no significant difference between the basic yields of the plots, but the standard errors are high.

36. Rejuvenation experiments on old coffee: These experiments started at Balehonnur and at Chethalli were abandoned as only stumping at 18" from ground level was satisfactory and the other treatments were failures. The time of the treatments (May-July) was apparently too late for the suckers to develop.

37. Single v. multiple stem of growing coffee:

ARABICA

Experiment I

Locality: Balehonnur (Mysore) *Layout:* AB, BA pattern.
Variety: 288, 333, 434, 434 *Plot:* 6 × 16.
 & Kent (each selection *Spacing:* 6' × 6'
 having 12 rows of 16 *Age of plants:* 6 years (from seed).
 plants in each row).
Treatments: 2 *Shade:* Natural shade
Replications: 6 *Period of conversion:* May 1950
 Area of Experimental
 block: 95.2 cents.

Treatments:

- A—Plants on single stem.
 B—Plants on multiple stem (three Suckers)

Note:—Plots under conversion to multiple stem had their primary branches on one side cut during the year of conversion to encourage sucker

growth; primaries on the opposite side were retained during the year to get the benefits of a crop while the plants are under conversion to multiple stem. These were later cut down after harvesting the crop and the plants stumped to a height of 18 inches from ground level, leaving however a lung branch at about the top level for keeping the stump alive.

TABLE XXIV—Yield records of plots on single stem and those under conversion to multiple stem

PLOT No.	VARIETY	Yield of ripe cherry (actual) in lb. and calculated yield of clean coffee in cwt. per acre of 1,200 plants					
		A. Single stem plots			B Plots under conversion		
		Ripe cherry	Clean coffee		Ripe cherry	Clean coffee	
		lb.	oz.	cwt.	lb.	oz.	cwt.
1.	288	... 56	2	1·05	58	13	1·09
2.	333	... 74	9	1·39	16	8	0·30
3.	Kents	... 79	1	1·47	58	4	1·08
4.	433	... 73	6	1·36	70	14	1·31
5.	434	... 99	9	1·77	41	13	0·75
6.	Kents	... 65	1	1·15	34	5	0·61
	Total	... 447	12	1·33	280	9	0·87

N.B. — For calculating the clean coffee, 6 lb of ripe cherry has been taken to yield 1 lb. of clean coffee.

Experiment II.—An experiment on randomised replicated pattern has been commenced (March 1951) to find out a convenient method of converting coffee on single stem to multiple stem. A plot of 17-year old coffee that was raised to single stem has been used for the purpose. The plot contains leaf-disease resistant varieties and susceptible varieties. The treatments are :—

A—Single stem (control).

B—Primary branches on one side pruned off to encourage free development of healthy suckers.

C—Extended suckering to one foot from the centre to facilitate free development of healthy suckers.

D—Except the top two primary branches all the other branches cut for free development of healthy suckers.

The plants in treatments B, C, D are under conversion to multiple stem. Three vigorous suckers have been allowed to develop on the plants.

ROBUSTA

Experiment I.—In a small plot of 16 rows of 8 plants each, about 16 years old and trained to single stem, alternate rows were stumped during August 1950 to a height of 18 inches from ground level allowing three suckers to develop for forming multiple stems. The suckers are developing well, but they have not borne a crop. The other rows on single stems form the controls.

Experiment II.—A plot of 72 cents of 4-year old robusta coffee trained on single stem system was divided into quadrants. In the opposite quadrants the plants were stumped during August 1950 to a height of 18 inches from ground level and three suckers were allowed to develop to form multiple stems. The suckers are developing well, but they have not borne a crop.

38. The use of plant hormones on the prevention of fruit drop

Locality:	Balehonnur	Layout:	Randomised block
Variety:	Arabica	Plot:	Single plants as units
	(S 31 clones)	Spacing:	6 ft. × 6 ft.
Treatments:	13	Shade:	Natural shade
Replications:	3	Area of Exptl. plot:	3.3 cents

TABLE XXV

DOSAGE OF HORMONES SPRAYED		% FRUITS DROPPED	
<i>Methoxone</i> (I C.I. Product—Agroxone liquid—10 % Methoxone)			
A.	160 parts per million	...	39.7
B.	20 " "	...	21.0
C.	5 " "	...	28.5
<i>Fernoxone</i> (I.C.I. Product)			
D.	160 parts per million	...	34.5
E.	20 " "	...	36.3
F.	5 " "	...	32.8
<i>Phyomone</i> (I C.I. Product)			
G.	160 parts per million	...	46.4
H.	20 " "	...	53.3
I.	5 " "	...	37.9
<i>Planofix</i> (M. & B. Product)			
K.	1 part in 100,000 parts	...	29.1
L.	1 " 200,000 "	...	84.1
M.	1 " 400,000 "	...	41.0
N.	<i>Control</i>	...	31.6
	Significant or not	...	No.
	Critical difference	...	33.65
	Conclusions	...	BCJMFDEIALGKH

39. **Effect of weed-killers:** Experiments were continued on the study of the relative value of several weedicides in the control of weeds in coffee plantations. The results are furnished below.

TABLE XXVI—Effect of weed-killers on coffee estate weeds—
Balehonnur (Mysore)

St. No.	WEEDICIDES	Strengths used per acre	Period of application	EFFECT ON WEEDS
1.	Agroxone ...	1 gal. in 100 gals. water.	Post-mon-soon	<i>Ageratum conyzoides</i> (Goat-weed), <i>Eidens pilosa</i> (Spanish needle) and <i>Gynura angulosa</i> , the commonest weeds in coffee estates were all affected especially in the seedling stages. No marked effect was noticed on <i>Mimosa pudica</i> (Touch-me-not).
2.	Fernoxone...	1.25 lb. in 100 gals. water.	—do—	
3.	Dicotox ...	1 gal. in 100 gals. water.	—do—	
4.	—do— ...	2 gals. —do—	—do—	Deadly to all the common weeds mentioned above and to <i>Mimosa pudica</i> especially at the higher strengths used.
5.	—do— ...	3 gals. —do—	—do—	
6.	Stanvac weed-killer.	10 gals. in 40 gals. Diesel oil.	—do—	Effective against the weeds mentioned above and against grass.
7.	Diesel oil.	40 gals.		Not or only slightly effective.

40. Studies in the germination of coffee seeds:

The object of this experiment was—

- (a) to evolve practical methods of hastening germination by pre-treatments;
- (b) to study the relative merits of different media used for germination and
- (c) to find out proper methods of storage of seeds.

(a) *Chemical methods*: Trials were conducted on coffee seeds both with parchment cover and without parchment cover by coating the moist seed with 4 per cent and 8 per cent Fernosan (an I.C.I. Product). Unlike tea where the chemical is reported to have hastened germination, no difference was noted between treated and untreated seeds of coffee.

(b) Relative merits of different media for germination were tried with seeds in which parchment skin was intact and those in which the parchment was removed. Details of this experiment are furnished below.

Locality: Coffee Research Station, Balehonnur (Mysore)

Date of treatment: 27-3-1951.

Variety: Kent's arabica seeds.

No. of seeds per treatment: 200.

No. of treatments: 4.

Replications: 4 times.

Treatments:

- A. Soil sowing $\frac{1}{2}$ inch deep and covering with straw mulch $1\frac{1}{2}$ " thick and watering daily.
- B. Sowing on the surface of the soil and mulching with straw 5" to 6" and watering daily.
- C. Seeds germinated between bundles of straw placed on a wooden platform, watering daily.
- D. Mixing seed with 6 parts by volume of soil in baskets and watering; repeating the process after 10 days.

The results are furnished in table XXVII:

(c) In the next experiment the following variants in storage of seed were tested:

- A. Stored in air-tight tins *v.* Ordinary storage in gunny bags.
- B. Ash-coated *v.* not coated.
- C. With parchment cover and without parchment cover.
- D. Soil and sand medium.

The results are furnished in tables XXVIII and XXIX.

41. **Mulching experiments.** Application of banana trash has been found to increase the nitrogen content and organic matter, also to conserve moisture and enhance the yields at Moshi. But coffee is grown there at higher elevations in the open without shade or with sparse shade. At Balehonnur, a block of young coffee of two years' growth was chosen for trials. An experiment was laid out with latin square design, 4 x 4. The treatments are:—

1. Banana trash applied @ 40 lb. per tree as at Moshi.
2. Green leaves from jungle @ 40 lb. per tree.
3. *Crotalaria anagyroides* sown in May between lines of coffee to be cut and mulched.
4. Control (no treatment).

Banana trash and green leaves were applied between the rows of coffee in February following deep digging done in January. The experiment will be continued for 5 to 6 years as a long-term trial and applications of trash and leaves will be done after the rains every year. Periodical

TABLE XXVII—Results of germination trials with different media

TREATMENT	OBSERVATION OF RADICLE GROWTH AFTER														
	Eighteen days				Twenty eight days				Fifty three days						
	With parchment	Without parchment	Germination not started ...	In about 50% seeds $\frac{1}{8}$ " to $\frac{1}{4}$ "	With parchment	Without parchment		Standard error	Height of seedling.	With parchment		No. of branch roots	Length of tap root	No. of branch roots	Root growth after 18 days (without parchment)
						Mean length $\frac{1}{16}$ "	Height of seedling.			Length of tap root	Height of seedling				
A.	Germination not started ...			About $\frac{3}{8}$ "		10.81	ins. 1.76	0.6125	ins. 1.76	ins. 3.76	10.5	ins. 1.16	ins. 2.96	10	Fair
B.	Seeds just swelling ...		—do— $\frac{3}{8}$ " to $\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "		15.99	2.30	0.8481	2.30	4.40	12	1.28	2.89	10	Root hair profuse
C.	Germination not started ...		—do— $\frac{1}{8}$ " to $\frac{1}{4}$ "	Not germinated		4.53	1.32	0.2490	1.32	2.6	9	Not germinated			No root hairs
D.	Seeds just swelling ...		—do— $\frac{1}{8}$ " to $\frac{1}{4}$ "	$\frac{1}{16}$ ' to $\frac{1}{8}$ "		7.39	1.10	0.4476	1.10	2.60	7	0.25	0.75	5	Root hair fair
Conclusions on observations on radicle growth after 28 days :—															
B better than A, C and D.															
A better than C and D.															
D better than C.															

TABLE XXVIII—Percentage of germination, with age of seed—average of four replications

AGE OF SEED IN FORTNIGHTS FROM PICKING DATE	COMBINATION OF TREATMENTS								MAIN AND SUB-TREATMENTS					MEAN FOR THE MEDIUM	
	AIR-TIGHT TINS				GUNNY BAGS				Air- tight tins	Gunny bags	Ash- coated	Not ashed	No husk		With husk
	ASH-COATED		NOT ASHED		ASH-COATED		NOT ASHED								
	No husk	With husk	No husk	With husk	No husk	With husk	No husk	With husk							
TABLE XXVIII—Sand medium															
1.	94	93	94	94	94	93	92	92	93-8	92-8	93-5	93-0	93-5	93-0	93-3
2.	90	90	91	91	92	92	92	92	90-5	92-0	91-0	91-5	91-3	91-3	91-3
3.	90	92	86	87	91	88	86	80	88-8	86-3	90-3	84-8	88-3	86-8	87-5
4.	90	92	80	88	84	90	87	84	87-5	86-3	89-0	84-8	85-3	88-5	86-9
5.	84	91	79	87	87	87	81	81	85-3	84-0	87-3	82-0	82-8	86-5	84-6
6.	83	83	77	75	76	81	74	73	79-5	76-0	80-8	74-8	77-5	78-0	77-8
Total	531	541	507	522	524	531	512	502	525-4	517-4	531-9	510-9	518-7	524-1	521-4
Mean	88-5	90-17	84-5	87-33	87-33	88-5	85-3	83-67	87-57	86-23	88-65	85-15	86-45	87-35	86-9
Significance of regression coefft	Sig.	Not sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
TABLE XXIX—Soil medium															
1.	95	94	94	94	95	94	95	94	94-3	94-5	94-5	94-3	94-3	94-5	94-4
2.	94	93	94	93	95	95	93	91	93-0	94-0	93-8	93-3	93-5	93-5	93-5
3.	93	92	92	91	91	91	79	84	92-0	88-0	91-8	88-3	91-8	88-3	90-0
4.	91	89	77	77	89	91	77	77	83-5	83-5	86-5	80-5	84-0	83-0	83-5
5.	84	92	74	83	81	86	77	79	83-3	81-8	85-0	80-0	81-8	82-5	82-5
6.	78	80	80	80	75	74	68	73	77-0	74-3	73-3	73-0	75-5	75-8	75-6
Total	535	540	499	518	526	531	489	498	523-1	516-1	524-9	509-4	520-9	518-4	519-5
Mean	89-17	90-0	83-17	86-33	87-67	88-50	81-5	83-0	87-18	86-02	87-48	84-98	86-81	86-40	86-58
Significance of regression coefft	Sig.	Misses significance	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

Note:— Significant . . . P = 0.05 level

samples of soil will be taken to determine their moisture content and basic fertility. Records of plant growth and yields will be taken from year to year.

42. Conditions favouring vegetative propagation of coffee.

Investigations by a number of workers have proved that important groups of substances which are limiting factors in the production of roots in cuttings are (1) auxins, (2) carbohydrates and (3) nitrogenous substances. Absence of sufficient response to auxin treatment in many cases have been traced to the lack of proper balance between the three groups of substances or insufficiency of one or more of them which were found to be specific as well as seasonal. With a view to get greater percentage of success in the rooting of coffee sucker cuttings and to reduce the mortality in the clonal material when transplanted, an experiment was started in June. It consisted in treating the sucker cuttings with auxins, carbohydrates and nitrogenous substances separately and in combination. The investigation was meant to study the optimum doses and time of application of the treatments to produce beneficial effects in coffee. The first trial consisted in dipping the basal ends of the single-noded leafy cuttings in the different solutions for 12, 24 and 48 hours. It was found that 48 hours and 24 hours treatments were definitely more injurious than 12 hours treatment. Further work is in progress.

43. **Control of moss growth on coffee stems:** Preliminary trials were conducted to test the effect of Diesel oil on moss growth on coffee stems and to observe whether the oil has any deleterious effects on the plants on application to the bark. The oil was applied during August and September 1950. Details are given below :—

<i>Treatment</i>	<i>Observations</i>
1. Diesel oil applied on the moss growth on stems.	Growth of moss was checked.
2. Diesel oil applied on the stems after removing moss.	Plants were not affected by the treatments.
3. Diesel oil applied on the stems after scrubbing the bark.	

IV. PLANT PROTECTION

44. **Time and Strength of Bordeaux spray.** This experiment which was begun in 1944 was continued in 3 localities in Coorg viz., Kirgandur (N. Coorg), Luxmi (Central Coorg) and Ghattadhulla (S. Coorg):—

Locality: Coorg (3 zones).
Year: 1950-51.
Variety: Arabica (Coorg).
Shade: Natural Shade.
Layout: Split-plot design.
Main replications: 6

Size of plot:
 Gross—6 x 16 trees.
 Nett—4 x 16 plants.
Treatments:
 Main 3,
 Sub. 2.

TABLE XXX—Percentage of leaf survival and yields in relation to time, strength and zone

TREATMENTS		Effective percentage of leaf survival			Yield per acre in 1951	
		Feb. 1950	Sept. 1950	Feb. 1951	Ripe cherry-lb.	Clean coffee cwt
Gen. mean		15.1	36.1	24.1	2400	3.57
<i>Main treatments :</i>						
A.	Pre-monsoon	14.7	36.3	23.4	2560	3.81
B.	Pre & Post	15.7	35.7	23.9	2380	3.54
C.	Post-monsoon	15.0	36.2	24.9	2280	3.39
	Std. error	2.59	2.22	1.72	5.88	5.88
	Sig. or not	No	No	Yes	No	No
	Crit. diff.	1.1	2.3	1.2	408	0.61
	Conclusions	B,C,A	A,C,B	C,B,A	A,B,C	A,B,C
<i>Sub-treatments :</i>						
E.	Bordeaux 4-4-40	15.1	36.4	23.8	2460	3.66
F.	do 2-2-40	15.1	35.7	24.3	2340	3.48
	Std. error	2.17	1.34	1.27	5.78	5.78
	Sig. or not	No	No	No	No	No
	Crit. diff.	0.9	1.4	0.9	394	0.59
	Conclusions	F,E	E,F	F,E	E,F	E,F
<i>Zones :</i>						
K.	Kirgandur	18.2	39.3	25.7	2800	4.17
L.	Luxmi	15.7	26.2	25.9	1600	2.38
G.	Ghattadhulla	11.4	42.7	20.7	2820	4.20
	Std. error	2.59	2.22	1.72	5.88	5.88
	Crit. diff.	1.1	2.3	1.2	408	0.61
	Sig. or not	Yes	Yes	Yes	Yes	Yes
	Conclusions	K,L,G	G,K,L	L,K,G	G,K,L	G,K,L
<i>Significant interactions :</i>						
Time X Locality (Feb. 1950)						
		A	B	C	Conclusions	
Std. error :	K.	20.6	17.9	16.1	A,B,C	
4.48						
Crit. Diff :	L.	13.7	17.4	16.1	B,C,A	
2.0	G.	9.8	11.7	12.6	C,B,A	
Conclusions		K,L,G	K,L,G	K,L,G		
<i>Significant interactions :</i>						
Time X Strength (Feb. 1951)						
		A	B	C	Conclusion	
	E.	22.5	23.5	25.5	C,B,A	
	F.	24.4	24.2	24.4	A,C,B	
Conclusions		F,E	F,E	E,F		
					Std. error :	2.20
					Crit. diff. :	1.5

(a) *Percentage of leaf survival :*

(i) *February 1950 :* There are no differences among the treatments in respect of periods of spray, nor between strengths of mixture. There are significant differences among localities. The effect of the different periods of spray varies with different localities.

(ii) *September 1950 :* There are no significant differences among the various treatments except in the case of zones.

- (iii) *February 1951*: Post-monsoon treatment has carried more leaf than the other two treatments.

(b) *Yields*:

Ghattadhulla and Kirgandur are on a par and both better than Luxmi.

From the three years' results it is found that there is consistency in the difference in yield between localities, but the effects of time or strength of spray are not consistent.

45. **Use of 'wetters' and 'spreaders' with Bordeaux spray.** The experiment in Coorg with different strengths of Teepol X was continued.

Locality: Ghattadhulla (Coorg)

Layout: Randomized

Size of plot: Gross—4 x 30

block 4 x 6

Nett—3 x 30

Treatments:

A. Bordeaux 2-2-40.

B. — do — + $\frac{3}{4}$ oz. Teepol X in 40 galls.

C. — do — + $1\frac{1}{2}$ oz. —do— —do—

D. — do — + 3 oz. —do— —do—

(a) *Leaf counts*:

TABLE XXXI

TREAT- MENT	Sep 1946	Sep 1947	Sep 1948	Sep 1949	Sep 1950	Feb 1947	Feb 1948	Feb 1949	Feb 1950	Feb 1951
A	23.7	23.4	24.6	25.7	45.2	11.1	15.7	11.9	10.2	21.2
B	32.0	28.5	24.4	32.5	44.4	14.3	16.6	13.9	11.7	22.8
C	23.2	29.6	25.4	21.7	41.6	14.1	18.4	14.7	11.6	23.6
D	29.4	29.1	23.2	20.9	40.9	14.2	18.1	14.7	11.5	22.5
Gen. mean	27.1	27.7	24.4	25.9	43.0	13.4	16.7	13.6	11.3	22.5
Sig. or not	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No
Std. error.	10.92	4.73	6.27	5.40	5.65	8.06	5.33	4.01	4.28	8.46
Conclusion	CBDA	CDBA	CABD	BACD	ABCD	BDCA	CDBA	CDBA	BCDA	CBDA
Crit. diff.	6.3	2.8	4.6	4.2	7.3	2.3	1.9	1.6	—	5.7

(b) *Yield data per acre*

TREATMENTS	Ripe cherry in pounds				Clean coffee in cwt.			
	1948	1949	1950	1951	1948	1949	1950	1951
A	3520	2683	3680	3880	5.24	3.93	5.47	5.77
B	4840	2077	4300	5920	7.20	3.09	6.40	8.81
C	4440	2680	4240	5380	6.61	3.93	6.34	8.01
D	3680	2930	3200	5100	5.65	4.36	4.76	7.59
Gen. mean	4115	2593	3855	4820	6.13	3.86	5.74	7.17
Sig. or not	Yes	No	No	No	Same as for cherry			
Std. error		16.35		13.35	Same as for cherry			
Crit. difference		1543		1939	2.30			
Conclusions	BCDA	ACDB	BCDA	BCDA	Same as for cherry			

None of the three doses of Teepol X has shown its superiority over plain Bordeaux either in leaf counts or in yields. This is again inconsistent with previous years results.

46. The experiment which was started in Coorg to compare Albolium with Teepol X was continued. The results are furnished below :—

Locality: Ghattadhulla (Coorg).

Layout: Randomized
blocks 3 × 6

Treatments: A. Bordeaux 2-2-40.

B. —do— —do— + 1 oz. Teepol X per 40 gals.

C. —do— —do— + 2 oz. Albolineum per 40 gals.

TABLE XXXII—Results of Teepol X and Albolineum as 'spreaders'

Date of observation	TREATMENTS			Gen. mean	Sig. or not	Std. error	Crit. diff.	Con-clusion
	A	B	C					
LEAF SURVIVAL								
Sep. 1948	22.2	25.8	25.8	24.6	No	7.8	6.0	<u>C,B,A</u>
Sep. 1949	21.8	22.0	23.9	22.5	No	9.4		<u>C,B,A</u>
Sep. 1950	47.6	47.5	47.6	47.6	No	4.54	2.3	<u>A,C,B</u>
Feb. 1949	11.9	13.5	11.8	12.4	No	7.3		<u>B,A,C</u>
Feb. 1950	10.0	11.9	13.3	11.7	Yes	7.1	2.7	<u>C,B,A</u>
Feb. 1951	15.2	15.9	17.2	16.1	No	4.61	6.9	<u>C,B,A</u>
YIELD IN 1949 (per acre)								
Ripe cherry in lb.	2553	2653	2993	2737	} No	14.2		<u>C,B,A</u>
Clean coffee in cwt.	3.81	3.95	4.46	4.07				
YIELD IN 1950 (per acre)								
Ripe cherry in lb.	2860	3380	3700	3200	} No	7.30		<u>C,B,A</u>
Clean coffee in cwt.	4.26	5.03	5.51	4.76				
YIELD IN 1951 (per acre)								
Ripe cherry in lb.	2780	2160	2520	2480	No	9.67	7.55	<u>A,C,B</u>
Clean coffee in cwt.	4.14	3.21	3.75	3.69	No	9.67	1.12	<u>A,C,B</u>

For the third year in succession there is significant difference in yields between plain Bordeaux and Bordeaux *plus* 'spreaders'. But out of six observations of leaf counts, in 5 there is no significant difference, but in February 1950, the addition of Albolineum is better than plain Bordeaux.

47. Comparison of Bordeaux mixture with copper sandox. This experiment started at Chethalli during October 1949 was continued. The strength recommended by the firm is 1 lb. in 40 gallons. However, a higher strength of 2 lb. in 40 gallons was also included in the trials. The results of the leaf counts and yields are as under:—

Layout: Randomized block 4 × 5.

Treatments:

A. Control (no spraying).

B. Bordeaux mixture 2-2-40.

C. Copper sandox 2 lb. in 40 gallons.

D. Copper sandox 1 lb. —do—

TABLE XXXIII—Comparison of Bordeaux mixture with copper sandoz

Treatment	Effective percentage of leaf survival			Yield per acre	
	Feb 1950	Sep 1950	Feb 1951	Fruits-lb.	Clean coffee
A.	13.5	18.1	23.0	2400	3.571 cwt.
B.	17.3	42.4	20.9	2600	3.869 "
C.	16.2	28.1	20.8	2940	4.375 "
D.	17.5	31.3	21.5	2360	3.512 "
Mean	16.1	24.0	21.5	2480	3.690 "
Sig. or not	No	Yes	No	No	No
Std. error	7.34	12.01	5.09	8.64	8.64
Crit. diff.	3.6	8.9	3.4	660	0.98
Conclusions	D,B,C,A	B,D,C,A	A,D,B,C	C,B,A,D	C,B,A,D

Out of three leaf counts, those taken in Feb. 1950 and Feb. 1951 show no difference between treatments while in Sept. 1950 plain Bordeaux is the best followed by Copper sandoz, these in turn are better than 'nonspray'. In yields there is no significant difference.

48. **At Balehonur, another experiment has been** started to find out the relative merits of the following copper fungicides and 'wettters' and 'spreaders' compared to plain Bordeaux.

1. Bordeaux mixture 2-2-40 plain (Control) in 40 gallons.
2. —do— —do— + $1\frac{1}{2}$ oz. Teepol X, —do—
3. —do— —do— + $1\frac{1}{2}$ oz. Lissapol, —do—
4. —do— —do— + 2 oz. Agral II —do—
5. —do— —do— + 1 oz. Agral III —do—
6. —do— —do— + $7\frac{1}{2}$ oz. Corvus oil —do—
7. —do— —do— + 6 oz. Stanvac detergent —do—
8. —do— —do— + 6 oz. Shell foliol —do—
9. Copper sandoz in water @ 1 lb. in 40 gallons
+ $1\frac{1}{2}$ oz. Lissapol, —do—
10. Perenox —do— —do— + $1\frac{1}{2}$ oz. Lissapol, —do—
11. Yellow cuprocide —do— + $1\frac{1}{2}$ oz. Lissapol, —do—
12. Shell copper fungicide —do— + 0.6 pint Arkotine —do—

The experiment will be continued for 5 years with two sprayings every year, the pre—and post-monsoon. Yields from the plots and leaf counts in Feb-Mar. and September will be recorded in one replication of all the treatments.

49. In a second experiment started at Balehonnur early in June, following different strengths of Bordeaux are being compared with a proprietary product containing 80 per cent copper sulphate, 10 per cent nickel sulphate, 9 per cent zinc sulphate and 1 per cent sulphuric acid in a 3-fold replication.

1. Bordeaux mixture 2-2-40
2. —do— $1\frac{1}{2}$ - $1\frac{1}{2}$ -40
3. —do— 1-1-40
4. Proprietary Product $2\frac{1}{2}$ - $2\frac{1}{2}$ -40

50. **Incidence of black bean.** To study the possible causes of black bean in coffee, a fresh experiment with a new set of treatments was started early in May 1950. One hundred branches were labelled for each of the following treatments.

- A. Bearing branches completely defoliated.
- B. Bearing branches not defoliated but ring-barked at every internode.
- C. Bearing branches ring-barked at every internode and also completely defoliated.
- D. Control—bearing branches neither defoliated nor ring-barked.

TABLE XXXIV—Incidence of black bean

TREATMENT	Total fruits	Total beans	Flats	Pea-berry	Spotted beans	EMPTIES
A. ...	760	1449	1371	72	15 (1.01%)	28 (1.9%)
B. ...	793	1506	1434	75	18 (1.2%)	29 (1.9%)
C. ...	782	1504	1444	60	21 (1.4%)	19 (1.3%)
D. ...	1125	2142	2051	93	1 (0.047%)	20 (0.9%)

The black beans are less in the control than in the treated cases, the incidence however is very small in all cases.

51. In another experiment, the effect of spraying Bordeaux as against no spraying in respect of incidence of black bean is under study. Spraying was done shortly after the blossom showers in April 1951 on 100 branches alongside 100 branches taken as control. The beans will be examined during the ensuing picking season.

52. **Coffee pests.** Two sets of experiments started in October 1949 for the control of coffee stem borer (*Xylotrechus quadripes*) one at Chethalli and the other at Biccode (Mysore) were continued. The treatments consisted of 1% D. D. T. and 1% B.H.C. (Benzene hexa chloride) with the following formulations and control.

D. D. T.	B. H. C.
70-80% Technical = $5\frac{1}{3}$ oz.	50% B. H. C. to contain 6.4%
Gum arabic = 3 oz.	of gamaisomer = 8 lb
Gelatine = $1\frac{1}{2}$ oz.	Water ... = 40 gallons.
Water = 40 gallons.	

The infested trees were removed before the two flight seasons and their progressive numbers till June and July 1951 are given in table below.

TABLE XXXV—Insecticidal control of stem-borer

LOCALITY	PARTICULARS	D.D.T.	B.H.C.	CONTROL
Chethalli	Total number of trees treated	... 1109	1074	1061
	Total bored trees removed upto 30-6-51	... 298	239	314
	Infested tree percentage	... 26.9	22.3	29.6
Biccode	Total number of trees treated	... 1540	1563	1542
	Total bored trees removed upto 12-7-51	... 302	268	572
	Infested tree percentage	... 19.6	17.1	37.0

At Biccode, both D. D. T. and B. H. C. are found to have better effect than control while at Chethalli the effects are not so marked.

53. Another experiment has been started at Gundikhan estate in Balehonnur with the following treatments under 6-fold replications.

- A. Control.
- B. Gammexane P. 520—1% water suspension.
- C. D. D. T. 50% Technical—2% water suspension.
- D. Gammexane P. 520 three parts, D.D.T. $\left\{ \begin{array}{l} 12\frac{1}{2} \text{ lb. of mixture in 100} \\ 50\% \text{ Technical two parts} \end{array} \right\}$ gallons water.
- E. Acrodel 1 lb. in 100 gallons of water.
- F. —do— 2 lb. —do— —do—

G. Gammexane in oil $\frac{3}{4}$ lb. in 100 gallons BOC white oil.

H. —do— 2 lb. in 100 gallons BOC white oil.

The experiment is in progress.

54. An observation on cut stems infested with borers during the October flight season was made and the following were recorded.

No. of stems examined.	Young grubs.	Full-grown grubs.	Pupae	Adults ready to fly
23	34	22	19	19

This shows that not all the insects emerge as adults during the flight period, but the process would appear to continue beyond the definite flight period. Hence it indicates the necessity for regular borer removal rounds even beyond the regular flight periods.

55. **Green bug (*Lecanium viride* Gr.).** A small-scale trial was conducted at Chethalli in July 1950 to study the efficacy of (1) Derriphyt-an 1 lb. in 10 gallon and (2) Fish-oil-rosin-soap 2 lb. in 10 gallons along with 1 lb. of soda ash. The former was quicker acting giving 100 per cent kill in a week while the latter also was equally effective but took 10 days to show its effects.

56. Another trial was conducted at Boothanhadloo in February 1951 in which Albolineum $1\frac{1}{2}$ per cent and 3 strengths of Derriphytan were compared with Fish-oil-rosin soap 2 per cent with 8 oz. of soda ash. It was observed that Albolineum killed most of the mother bugs in about 10 days time. Derriphytan 1 per cent and Fish-oil-rosin soap-soda mixture came next in order. But in all cases fresh brood of young ones appear indicating the necessity for a second treatment closely following the first.

57. **Abnormal leaf and fruit fall.** A simple experiment on the *ABBA* plan was laid out at Galikere Estate in order to find out if the abnormal leaf and fruit fall noticed in the estates situated in the Jagara Valley of the Bababudangiris was due to any kind of Bordeaux injury caused by the mist:—

Locality: Galikere Estate (Mysore).

Layout: *ABBA*.

Treatments: 2.

Replications: 6.

Variety: Arabica (Coorgs).

Treatments:

Plot size: 8 x 5.

Spacing: 6' x 6'.

Shade: Natural shade.

A. Copper sulphate 2 lb. quick lime 2 lb. in 40 gallons of water.

B. Copper sulphate 2 lb., quick lime 3 lb. in 40 gallons of water.

Quantity of spray: 400 gallons per acre.

The leaf mulch around the base of the plants along the diagonal of each sub-plot was swept away at the beginning of the experiment. The number of leaves and berries that dropped from these plants was counted every month. The leaves were classified as (a) apparently healthy and (b) leaves affected by leaf disease. The following table gives the results obtained:—

TABLE XXXVI—Results of experiments on abnormal leaf and fruit fall at Galikere Estate

MONTH	TREATMENT A					TREATMENT B				
	Apparent-ly healthy leaves	LEAVES DROPPED			Total No. of berries of berries dropped	Apparent-ly healthy leaves	LEAVES DROPPED			Total No. of berries of berries dropped
		Due to disease	Due to me-chemical injury	Due to other causes			Due to disease	Due to me-chemical injury	Other causes	
1950										
June	90	...	...	...	1293	117	...	...	...	1503
July	32	...	...	...	2215	29	...	...	...	2956
August	...	1220	380	399	1999	...	1909	365	334	2608
September	...	2672	75	103	2850	...	3192	101	108	3401
October	...	136	12	...	148	...	222	16	...	238
December	...	158	16	...	174	...	204	14	...	218
TOTAL	...				8680					10,924
										1313

Standard error of mean difference = 187.65
 Mean difference = 422.38
 Critical difference = 460.57
 Significant or not = Not significant.

In treatment A less number of leaves are dropped, but the number of berries dropped is greater than in treatment B. Normally where less number of leaves are dropped, the number of berries dropped must also be less.

V. ROBUSTA PULPING EXPERIMENTS

Balehonnur:

58. A series of exploratory trials were conducted to find out the easiest method of preparing robusta parchment. It was found that :

- (i) Pulping of fresh berries was better than those presoaked in water for 24 hours.
- (ii) The wet parchment as it emerges from the pulper should be sieved to remove the accompanying skins.
- (iii) The reddish coloured fluid that collects along with the wet parchment should be drained and the parchment washed before leaving the heap to ferment.
- (iv) Twelve hours after pulping, the parchment must be washed once with water and drained. The addition of 6 oz. of clean wood-ashes per bushel of wet parchment facilitates thorough fermentation and loosening of the mucilage.
- (v) Thirty six hours after pulping, the parchment can be washed with frequent changes of water until it becomes clean.

Chethalli:

59. At Chethalli also some exploratory trials were done with pulping of robusta. Presoaking for 12, 24 and 36 hours was tried against pulping of fresh fruits. MacKinnons disc pulper was used and it was found that it did not make much difference between different treatments as regards pulping. But the chief difficulty experienced was in fermentation and washing. Fresh fruits were pulped giving an unusual wash to get rid of the bulk of the slime and the following measures were used to thin out the slime during under-water fermentation :—

- A. 0.1 per cent oxalic acid.
- B. 0.1 per cent citric acid.
- C. Clear lime water.
- D. Control (water).

In all cases a thorough washing was secured though with a little difficulty in 'Control'. In case of treatments A, B and D the mucilage thinned out while in the case of 'C' (lime water) it hardened and came off in lumps.

VI. EXTENSION SERVICE

60. The Liaison officer functioned throughout the year, but his headquarters was changed to Chethalli where in addition to his duties he was to take charge of the experiments pertaining to the sub-station.

61. He visited the Shevaroy hills, Palni hills, Singampatty, The High ranges, Nelliampathies, Bilgiris, Manajrabad taluk of Mysore, the Bababudangiris, the Malabar-Wynaad, the Nilgiris Wynaad, Eastern Nilgiris and the Anamalais. The coffee tracts of South India being discontinuously distributed under various elevations, rainfall and other climatic conditions, these tours were of special value in acquainting the headquarters station with a variety of problems facing the coffee planters in several districts. He was on tour for 104 days in the year and besides addressing the Planters' Associations, he visited individual estates and discussed with the management the particular problems pertaining to them. Thus he established very valuable educative contacts in which he learned their specific needs and at the same time offered them valuable advices based on the experiences of planters in other localities and the research work hitherto done by the department. This liaison work has added newer problems of research by

the Department than were in the immediate purview of the two Research Stations which are both situated in the predominantly S. W. Monsoon areas. During his liaison tours it was revealed that the smaller growers were in need of greater assistance than their bigger neighbours in advisory work on spraying, borer control, pruning, manuring and pest control. These will receive special attention during the current year.

VII. MISCELLANEOUS CROPS

62. **Paddy.** Paddy was grown over an area of 6.9 acres at Chethalli and about 2 acres at Balehonnur. Though the stand of the crop was fair at Chethalli, it was found that there was a large quantity of unfilled seeds which lowered the yield to a great extent. The following quantities were harvested during the year :—

	Grain (seers)	Straw (lbs.)
Chethalli ...	3,852 srs. (48 batties)	16,800
Balehonnur ...	2,260 srs.	12,000

In pursuance of a varietal trial scheme at Balehonnur, seeds of the following 5 varieties were obtained from the Government Farm of the Wynaad Colonization Scheme :—

- | | |
|--------------------------|-----------------------|
| 1. <i>Chettuvalian</i> . | 4. <i>Velumbala</i> . |
| 2. <i>Marthondi</i> . | 5. <i>Palthondi</i> . |
| 3. <i>Kothandan</i> | |

63. **Oranges.** The crop at Chethalli was poor during the year. The crop in 6 acres was leased out for Rs. 600 while that in the 26-acre plot was departmentally picked and sold through the Coorg Orange Growers' Co-operative Society Ltd. The harvest of 72,000 fruits was sold for Rs. 1,213-11-0. The oranges on the station were manured at 5 lb. of ammonium sulphate per tree during the year.

64. **Green manures.** Specimen plots of the following green manures were raised at Balehonnur :—

<i>Crotalaria anagyroides</i> .	<i>Sesbania speciosa</i> .
<i>C. usaramoensis</i> .	<i>S. aculeata</i> .
<i>C. Grahamiana</i> .	<i>S. aegyptiaca</i>
<i>Tephrosia candida</i> .	<i>Calapogonium mucunoides</i> .
<i>T. vogelii</i> .	<i>Centrosema pubescens</i> .

At Chethalli, the following quantities of green manure seeds were collected and sold realizing a sum of Rs. 251-4-0.

<i>Crotalaria anagyroides</i>	280 lb.	<i>Sesbania speciosa</i>	12 lb.
<i>C. usaramoensis</i>	$\frac{1}{4}$ lb.	<i>S. aegyptiaca</i>	2 lb.
<i>C. striata</i>	1 lb.	<i>Indigofera arrecta</i>	2 lb.
<i>C. agatiflora</i>	7 lb.	<i>Wild diancha</i>	10 lb.
<i>C. Grahamiana</i>	$2\frac{1}{2}$ lb.	<i>Cassia hirsuta</i>	2 lb.
<i>Tephrosia candida</i>	$\frac{1}{2}$ lb.	<i>C. tora</i>	$3\frac{1}{2}$ lb.
<i>T. vogelii</i>	$1\frac{1}{2}$ lb.		

65. **Fibre crops.** (a) *Jute*: The growth and development of jute sown in trial plots at Balehonnur were not satisfactory. The plants grew to a height of about 3 ft. and began to flower and produce fruits. In spite of frequent weedings, the plants did not compete favourably with weed growth. The fibre extracted was very poor in quantity as well as quality.

(b) *Crotalaria anagyroides*: The fibre extracted from the species of *Crotalaria* was sent to the Deputy Secretary to the Govt. of India, Ministry of Food & Agriculture, New Delhi and to the Principal, Harcourt Butler Technological Institute, United Provinces, Lucknow for trials. The percentage of fibre to the green material worked at $2\frac{1}{2}$ per cent only.

66. **Cotton.** At Balehonnur, specimen crops of *St. Vincent, Montserrat* (Sea Island cottons), *Moco* and *Queberdinho* (perennial cottons) were raised. During the first season the growth of the plants was poor and the harvest of cotton was negligible. At the commencement of the rains in 1951 they produced vigorous growth. The Sea Island cottons began to flower and set fruits during the rains, but the fruits rotted. Perennial cottons did not produce flowers during the rains. At Chethalli, the *Moco*, *Queberdinho* and *Barbadense* specimens of perennial cottons introduced and planted on the higher slopes of the station wetlands in September 1949 do not seem to do much progress. Some of the plants have obtained a height of $2\frac{1}{2}$ feet while the others are stunted.

67. **Tung oil.** At Balehonnur, sixty tung oil plants interplanted with coffee and all the plants planted at Chethalli in 1949 in the 1949 and 1950 clearings of coffee are making satisfactory growth. Some trees have attained over 12 feet in height. The Tung Oil officer who visited the Balehonnur Station has expressed appreciation about the growth of the plants.

68. **New shade trees.** (a) *Maesopsis eminii* and *Erythrina tomentosa* obtained from Africa are making satisfactory growth, the former have grown upto a height of 8 ft. in two years and have a spread of 9 feet. *Erythrina tomentosa* appears to be a thorny plant unlike *E. lithosperma*.

(b) Seedlings of *Cordia myxa*, *Trewia nudiflora* and *Cedrela toona* were raised in the nursery and planted later in observational plots.

69. *Common coffee shade trees of India:* Observations on the seasonal production of new growth, flowers and fruits and seasonal shedding of leaves by the shade trees are being recorded.

VIII. FARM MANAGEMENT

70. Both the stations continued to be subscribing members of the U. P. A. S. I. and its labour department and also of the regional Planters' Associations.

71. The average strength of the labour and their average turn-out during the period were as under:—

	Labour as on 1-7-50	Strength on 30-6-51	Average turn-out per day
Balehonnur ...	95	93	80.7
Chethalli ...	115	109	85

72. **Medical facilities.** Medical facilities at both stations were provided by the part-time services of the local medical officers of the Mysore and Coorg administrations. The anti-malarial squads of the local administrations attended to D. D. T. spraying of all estate quarters.

73. **Manuring.** The following table furnishes the areas manured during the year.

STATION	Period	Area (acres)	MANURE APPLIED AND QUANTITY	Rate per acre	C O S T		Total	C O S T PER ACRE
					Manures	Labour		
<i>Balehonnur</i>	July 1950 Sept. 1950	7	Groundnut oil cake	... 40 lb. N.	356 4 0	12 12 0	369 0 0	52 9 0
		10	Amm. sulphate and Groundnut oil cake	... 40 lb. N.	482 2 0			
			Bonemeal	... 30 lb. P ₂ O ₅	200 14 0			
	Oct. 1950		Cherry husk ash	... 40 lb. K ₂ O	142 14 0	40 11 0	866 9 0	86 10 0
		13½	Amm. sulphate and G.N. cake	... 40 lb. N.	593 5 0			
			Bonemeal	... 30 lb. P ₂ O ₅	241 1 0	50 15 0	1056 12 0	79 12 0
			Cherry husk ash	... 40 lb. K ₂ O	171 7 0			
	Nov. 1950	6½	Amm. sulphate, Groundnut oil cake and sodium nitrate	... 40 lb. N.	283 13 0	10 15 0	294 12 0	43 11 0
	Feb. 1951	19½	Amm. sulphate, G.N. cake and chilean nitrate	... 40 lb. N.	953 7 0	53 10 0	1632 15 0	83 12 0
			Bonemeal	... 30 lb. P ₂ O ₅	347 5 0			
			Cherry husk ash	... 40 lb. P ₂ O ₅	278 9 0			
<i>Chethalli</i>	April 1951	40½	Amm. sulphate and G.N. cake	... 40 lb. N.	1955 3 0			
			Bonemeal	... 30 lb. P ₂ O ₅	721 6 0	125 4 0	3380 6 0	83 8 0
			Cherry husk ash	... 40 lb. K ₂ O	578 9 0			
	Total	97 acres						
	Oct. 1950	7 acres	Sulphate of ammonia and Bone-meal 2:1	1½ oz. of mixture per plant				
	—do—	5 acres	— do —	1 oz.				
	Dec. 1950	67.75 acres	Sulphate of ammonia	... 20 lb. N.	— do —			
	Total	79.75 acres			1560 14 0	277 2 0	1838 0 0	22 15 6
								For the plants of 1949 clearin s. For the plants of 1950 clearings.

74. **Spraying.** Spraying arabica coffee with 2-2-40 Bordeaux mixture was done on both stations as per details below :—

STATION		Past-monsoon	Pre-monsoon	C O S T		Total	REMARKS
				Spray chemicals	Labour		
<i>Balehonnur</i>	76½ acres	80½ acres		1522 0 0	799 10 0	2321 10 0	Over an area of 3 acres, a double spray of
	68 "	"		1702 12 0	1413 8 0	3116 4 0	both post and pre monsoon was tried with an
							interval of about 1 month after the usual sprayings.
<i>Chethalli</i>							

75. **Borer control.** At Balehonnur 5320 borer infested trees were removed as against 5115 in the previous year. At Chethalli, 5997 borer infested trees were removed as against 9360 in 1949-50.

76. **Harvest.** Following are the harvest figures for coffee for the two stations.

	BALEHONNUR						CHETHALLI			
	Arabica		Robusta		Other coffee		Arabica		Robusta	
	Bus.	Srs.	Bus.	Srs.	Bus.	Srs.	Bus.	Srs.	Bus.	Srs.
A. Parchment ...	237	—	40	14			786	—	7	14
B. Dry cherry ...	347	—	56	21	6	—	278	—	2	14
C. Gleanings ...	87	—					79	—		
TOTAL ...	671	—	97	7	6	—	1143	—	10	—
Estimated yield of clean coffee ...	7 tons.						11.25 tons.			

IX. GENERAL

77. **Conferences and Exhibitions.** The Research Department participated in the following exhibitions and conferences.

1. U. P. A. S. I. Exhibition & Conference at Coonoor between the 25th and 31st August 1950.
2. Dasara Exhibition at Mysore between the 12th and 30th October 1950.
3. Planters' and Research Workers' conference and Joint exhibition of the Indian Coffee Board and the District Rural Development Committee, at Chikmagalur between the 20th and 30th April 1951.

The following papers were read at the U. P. A. S. I. Conference and at the Planters' & Research Workers' conference.

1. Multiple stem system of training coffee by K. M. Thomas, Director of Research, Indian Coffee Board.
2. The Nitrogen, Phosphate and Potash status of some coffee soils of South India and manuring By Dr. N. G. Chokkanna, Chemist, Indian Coffee Board.
3. Soil conditions and Plant growth in relation to coffee by Dr. N. G. Chokkanna.
4. The Agronomics of young coffee clearing By S. Sandaram, Agronomist, Indian Coffee Board.
5. Leaf Disease resistance and its importance in Coffee by R. L. Narasimhaswamy, A. Botanist, Indian Coffee Board.
6. Coffee improvement and Liaison service by T. V. Pattabhiraman, Liaison Officer, Indian Coffee Board.
7. A Coffee Nursery in Coorg by James Colaco, Superintendent, Coffee Research sub-Station.
8. Shade for coffee by E. Studer, Chikmagalur.
9. Enforcement of Pest Act for the control of Coffee Stem borer by Dr. M. Putrudriah, Dept. of Agriculture in Mysore.
10. Possibilities of increasing coffee production by Plant Protection by S. V. Venkatarayan, Department of Agriculture in Mysore.

11. Utilization of orange and jack fruits by Dr. G. S. Siddappa, Central Food Technological Institute, Mysore.
12. Processing and food value of tapioca and its products by Dr. D. Bhatia, Central Food Technological Institute, Mysore.

The departmental stalls at all the three exhibitions were visited by a large number of people. The departmental stall was awarded a *Gold Medal* certificate at the Dasara Exhibition and a Silver Cup and certificate at the Exhibition at Chikmagalur.

78. **Ad hoc Committees.** Five meetings of the *ad hoc* committee for Balehonnur and six meetings of the *ad hoc* committee for Chethalli and a joint meeting of both the committees were held during the year.

79. **Staff meetings.** Six staff meetings were held during the year at Balehonnur for discussing the programme of research work, administrative matters and social amenities of the Station.

80. **Library.** Thirty-four scientific journals were subscribed for besides journals received on an exchange basis. 46 volumes were added to the library. Photo copies of important articles were obtained. Loose numbers of journals were got bound into respective volumes. The total expenditure on library was Rs. 2,566-11-9.

81. **Correspondence.** The number of correspondence dealt with during the year was as follows:—

	<i>Balehonnur.</i>	<i>Chethalli.</i>
No. of letters received	5441	1511
No. of letters despatched	7944	1938

82. **Audit of accounts.** The audit of the accounts of the Research Department was done by Messrs. Fraser & Ross, Bangalore, for the year 1949-50.

83. **Publications.** Following contributions were made to the *Indian Coffee*.

1. Ways and Means of increasing yield of coffee in existing plantations—By K. M. Thomas.
2. Hints on robusta pulping—By Dr. N. G. Chokkanna and K. M. Thomas.
3. Three Liaison Officer's reports—By T. V. Pattabhiraman.
4. Three Quarterly Reports of the Research Department—By K. M. Thomas.

84. **Acknowledgements.** I have great pleasure in acknowledging the courtesy and willing cooperation I have had from the members and officers of the Board and from the members of the Research and *ad hoc* committees. I have to thank the planting community in general for their assistance and cooperation to me and to my staff in the conduct of our work. To the various grades of executive and ministerial officers, I am indebted for their loyalty and hard work. To the various scientists particularly to those engaged in coffee research, I owe my thanks for the exchange of their publications and plant material. This exchange of publications and plant material is bound to enhance the utility of the Research Department and for increasing the value of the Department for the coffee planting community in general.

K. M. THOMAS,
Director of Research.

APPENDIX I

Rainfall record of the Coffee Research Station, Balehonnur (Mysore)

MONTH	RAINFALL RECORDED IN INCHES DURING										Average for 10 years	Rainfall recorded in 1950-51 Inches
	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50		
July	29.94	32.16	45.95	47.43	41.61	37.52	35.80	35.97	30.93	24.60	36.19	58.25
August	33.85	21.31	20.14	9.89	10.09	10.72	37.93	30.34	39.49	25.52	23.93	20.11
September	3.07	5.34	5.39	16.11	2.92	9.11	11.51	9.80	6.43	14.80	8.45	21.12
October	7.71	8.76	7.18	15.29	12.42	4.25	3.56	2.62	6.80	7.99	7.66	6.43
November	7.05	0.21	0.21	2.53	2.71	1.08	7.04	1.14	8.59	1.43	3.10	1.27
December	0.70	2.22	1.87	0.01	0.07	0.00	1.09	0.91	0.08	0.00	0.69	0.00
January	0.05	0.00	0.47	0.03	0.00	0.00	0.36	0.26	0.00	0.02	0.12	0.00
February	0.00	0.00	0.00	1.00	0.00	0.03	0.00	0.00	0.00	0.74	0.18	0.00
March	1.05	0.00	0.15	0.60	0.00	0.52	1.86	0.19	0.44	0.00	0.48	0.53
April	1.66	4.63	2.06	1.04	3.92	9.05	1.56	9.94	2.16	0.79	3.68	3.84
May	4.46	5.49	11.76	5.78	2.73	4.28	5.21	2.41	6.61	3.77	5.25	8.43
June	24.34	19.52	13.47	7.81	8.65	23.53	9.90	15.67	10.50	11.57	14.50	17.88
TOTAL	123.88	99.64	108.15	107.52	85.82	100.09	125.82	109.25	111.43	91.23	104.23	137.86

APPENDIX II

Rainfall record of Coffee Research sub-station, Chethalli (Coorg)

MONTH	RAINFALL RECORDED IN INCHES DURING										Average for 10 years	Rainfall recorded in inches in 1950-51
	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50		
July	23.50	16.06	26.93	31.45	36.00	30.84	10.71	23.35	12.43	15.35	22.66	28.60
August	18.20	12.91	12.29	4.69	4.93	7.64	24.91	18.85	21.51	8.83	13.48	9.20
September	2.96	6.36	3.91	8.91	1.83	3.50	8.25	8.64	3.59	5.87	5.38	13.85
October	7.10	4.22	5.84	11.50	6.04	4.63	3.93	9.98	3.64	8.85	6.57	3.25
November	8.39	1.42	0.42	6.55	4.00	2.09	6.16	0.13	5.22	0.10	3.49	4.05
December	0.67	1.88	1.01	0.00	0.51	0.00	2.31	1.05	0.09	0.00	0.75	0.00
January	0.00	0.00	1.24	0.00	0.00	0.00	0.00	0.50	0.03	0.00	0.18	0.00
February	0.00	0.00	0.16	1.05	0.00	0.00	0.72	0.40	0.00	0.71	0.30	0.00
March	4.61	1.78	0.42	0.33	0.00	2.02	0.00	0.00	0.02	0.00	0.92	2.17
April	3.70	3.02	2.16	0.87	7.38	8.32	1.53	4.75	3.78	1.18	3.67	2.57
May	5.10	8.55	11.78	1.40	2.29	1.35	4.69	3.80	11.02	3.71	5.37	4.19
June	19.24	14.77	9.10	7.02	10.35	13.59	7.31	10.53	6.85	6.83	10.56	8.95
TOTAL	93.47	70.97	75.26	73.77	73.33	73.98	70.52	81.98	68.18	51.43	73.29	76.83

APPENDIX III

Meteorological data observed at the Coffee Research Station, Balehonnur (Mysore) during 1950-51

Sl. No.	METEOROLOGICAL OBSERVATIONS	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	REMARKS
1.	Highest maximum temperature °F	77.5	80.5	77.0	80.5	82.1	82.5	85.1	90.5	92.0	93.0	91.0	83.0	
2.	Lowest maximum temperature °F	68.1	69.2	69.5	71.2	73.1	76.0	77.2	82.1	83.2	82.2	81.0	70.2	
3.	Highest minimum temperature °F	67.0	67.0	67.4	67.5	66.4	63.4	64.0	63.1	66.7	71.0	71.0	68.0	
4.	Lowest minimum temperature °F	63.6	63.5	62.5	55.7	51.6	54.0	54.0	55.4	59.0	62.5	63.0	63.7	
5.	Average maximum temperature °F	71.3	74.7	66.8	80.0	78.8	80.0	81.7	85.4	89.3	87.0	85.6	5.3	
6.	Average minimum temperature °F	65.3	65.2	64.8	65.0	59.5	57.7	59.6	59.9	63.8	66.7	67.2	65.5	
7.	Average number of hours of bright sunshine	4.12	7.30	8.00	11.00	11.00	10.54	11.00	11.00	11.30	11.30	11.36	7.54	
8.	Lowest do	0.00	0.00	0.00	0.42	3.00	1.36	8.12	3.54	7.42	1.30	2.00	0.00	
9.	Average do	0.08	2.83	2.48	6.33	8.11	8.44	10.7	9.04	10.20	7.18	8.6	1.34	
10.	Number of days on which rainfall was below 10 cents	1	6	8	1	2	...	...	...	1	3	...	3	
11.	— do — between 10 to 50 cents	4	7	10	3	4	...	...	...	2	2	6	111	
12.	— do — between 50 to 100 cents	8	6	2	3	1	...	...	...	...	3	5	7	
13.	— do — between 1 to 2 inches	5	8	5	3	...	...	...	...	...	1	2	5	
14.	— do — above 2 inches	11	1	3	...	...	...	...	...	...	...	...	1	
15.	Total rainfall in inches	58.25	20.11	21.12	6.43	1.27	...	...	...	0.53	3.34	8.43	17.88	
16.	Number of rainy days during the month	29	28	28	10	7	...	...	...	3	9	13	27	
17.	Highest rainfall during the month	7.26	3.21	3.25	1.56	0.51	...	...	...	0.53	1.01	1.97	2.55	

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